Technology Grade 6

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Online:
< http://cnx.org/content/col11005/1.1/ >

C O N N E X I O N S

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Term 1

1.1 Processing[1]

1.1.1 TECHNOLOGY

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1.1.5 PROCESSING

PRIOR KN0WLEDGE

A. This module involves the changes that one type of material or several types of material can undergo to form a new product. We call this PROCESSING. In this module we will look specifically at processing FOOD. A variety of ingredients are needed for the purpose.

Examples of processing

Ingredients used	Processing	New Product
sweet corn, cream, milk, flavourants	add, simmer, stir	soup
eggs, milk, flavourants, butter	melt, beat, add	omelette
eggs, sugar, butter, milk, flour, cocoa, salt, baking powder, essence	beat, add, melt, sieve, fold in, add, mix, place in, bowl, turn out	a chocolate sponge cake

Table 1.1

1.1.6 Assignment

A. COMPLETE ON YOUR OWN:

[1]This content is available online at <http://cnx.org/content/m22613/1.1/>.

1. Use any recipe book or a magazine with recipes. Select any recipe and completeyour own table:
2. Write down all the equipment that you need to prepare your product:

Source of reference:
[LO 2.2]

1.1.7 Assignment

A. Use any explanatory dictionary and write down the meaning of each of the following processes for preparing food:

- blanch .
- chop .
- beat .
- marinate .
- decorate .

Source consulted: .....

Can you think of other processes? Write down as many as you can:
[LO 1.3]

A. When we prepare food, we call the materials we use **ingredients**. These can be vegetable (from plants) or animal (from animals). Go home and open your mother's food cupboard and fridge. Complete the following table by writing down at least five examples of each.

VEGETABLE INGREDIENTS	ANIMAL INGREDIENTS
e.g. Flour	Milk

Table 1.2

A. These ingredients must **be stored in the most suitable packaging** so that the food can **retain its nutritional value** for as long as possible, and **does not dry out, become moist or start to smell bad**.

[LO 1.2]
Link each type of food with the most suitable packaging to ensure the above:

TYPE OF FOOD		PACKAGING
A. Flour		Plastic bag
A. Bread		Tin
A. Milk		Polystyrenecontainer
A. Butter		Airtight container
A. Cannedsardines		Plastic bottle
A. Gravy powder		Cardboard box
G Apples		Plasticcontainer
H Canned peaches		Paper bag
I Pizza		Flat carton
		Tin

Table 1.3

[LO 2.2]

A. MEASURING UNITS FOR INGREDIENTS

1.1.8 Assignment

In what unit would you measure the following ingredients and what equipment would you use? Circle the correct answer.

INGREDIENT	UNIT	EQUIPMENT
1. milk	mℓ, g	measuring jug/scale

continued on next page

1. sugar	mℓ, g	measuring jug/scale
1. baking powder	mℓ, g	measuring jug/scale
1. butter	mℓ, g	measuring jug/scale
1. vanilla essence	mℓ, g	measuring jug/scale

Table 1.4

Conclusion:

Fluids are usually measured in a measuring jug. Solids are measured on a scale to determine the correct mass. Recipe books nowadays indicate all the ingredients in measure of capacity because it is quicker to use measuring jugs and spoons than weighing each ingredient on a scale.

1.1.9 Assessment

Learning Outcomes(LOs)

LO 1

TECHNOLOGICAL PROCESSES AND SKILLS

The learner will be able to apply technological processes and skills ethically and responsibly using appropriate information and communication technologies

Assessment Standards(ASs)

We know this when the learner:

1.2 finds out about existing products relevant to a problem, need or opportunity, and identifies and compares their design aspects (e.g. who it is for, what it is for, what it looks like, what it is made of, how well it works, whether it will affect the environment);

1.3 performs, where appropriate, scientific investigations about concepts relevant to a problem, need or opportunity using science process skills;

1.4 writes or communicates a design brief for the development of a product related to a given problem, need or opportunity that clarifies the technological purposes of the solution;

1.5 suggests and records at least two alternative solutions to the problem, need or opportunity that link clearly to the design brief and to given specifications and constraints (e.g. people, purpose, safety, environmental impact, appearance);

1.7 develops plans that detail the making steps, including drawings and sketches that help to clarify the plans;

1.8 chooses and uses suitable tools to make products by measuring, marking out, cutting or separating, shaping or forming, joining or combining, and finishing the chosen materials;

1.9 works efficiently and safely;

1.10 evaluates the product according to the design brief and given specifications and constraints (e.g. people, purpose, environmental impact, safety, appearance), and suggests improvements and modifications if necessary;

1.11 evaluates the plan of action followed and suggests improvements and modifications if necessary;

1.12 draws appropriate sketches (e.g. labelled two-dimensional drawings of ideas, enhanced drawings of final solutions and drawings showing measurements) to communicate different information appropriately and effectively.

LO 2

TECHNOLOGICAL KNOWLEDGE AND UNDERSTANDING

The learner will be able to understand and apply relevant technological knowledge ethically and

We know this when the learner:

2.2 demonstrates knowledge and understanding of the reasons for the deterioration of different materials, and ways of preserving them (e.g. drying, coating, canning, sealing).

1.1.10 Memorandum

(b)

1. Learners' own answers.
2. Own answers.

Vegetative	Animal
rice, cocoa, spaghetti, fruit, bread, jam vegetables, cooking oil, sugar, etc.	meat, eggs, butter, cream, cheese, yoghurt, fish, etc..

Table 1.5

(d)
(e) (a) cardboard box
(b) airtight container
(c) plastic bottle
(d) plastic container
(e) tin
(f) plastic bag
(f) (1) ml measuring jug
(2) g measuring jug; scale
(3) ml/g measuring jug; measuring spoon
(4) g scale
(5) ml measuring jug; measuring spoon

1.2 How to bake a bread[2]

1.2.1 TECHNOLOGY

1.2.2 Grade 6

1.2.3 BAKING

1.2.4 Module 2

1.2.5 HOW TO BAKE A BREAD

1. WHAT IS THE NEED

[2]This content is available online at <http://cnx.org/content/m22614/1.1/>.

1.2.6 Assignment

It is the end of the year and the Grade 6 learners intend closing the year on a high note with a braai. At a meeting you decided that you wanted salad, bread, sosaties and a pudding. You are in charge of the bread table and instead of toasting the bread over the flames, you have decided to obtain raw dough for white bread from the local bakery and process it.

What must we keep in mind?

Let us analyse the need.

(Key words: bake, fresh, tasty, bread, specific shape, braai)

[LO 1.4]

RESEARCH

Method 1
1. Roll out dough with rolling pin into flour sprinkled surface. 2. Sprinkle a packet of oxtail soup onto the dough. 3. Roll the dough into the form of a Swiss roll. 4. Place dough into greased baking pan. 5. Bake for 50 min in a pre-heated oven at 180° C.

Table 1.6

Method 2
1. Roll out dough with rolling pin into a rectangular shape onto flour sprinkled surface. 2. Push pitted black olives into dough at regular intervals. 3. Fold dough double and then double again. 4. Place dough into greased baking pan. 5. Brush with beaten egg. 6. Bake for 45 min at 190° C.
Method 3
1. Add pitted raisins to the dough. 2. Place dough into a greased baking pan. 3. Bake for 45 min at 190° C. 4. Mix icing sugar with milk and drip over surface of baked bread.

Table 1.7

1. Ideas

Consult recipe books, magazines and any other sources of reference to see how many ways you can find to meaningfully process bread dough. Three possibilities are printed.

Write down at least two ideas.

[LO 1.2]

Interesting names for breads

These days a large variety of bread, like pita and tramazzini, is served in restaurants. Check the shelves of your local supermarket and write down the names of five types of bread that you find.

1. Outing

Visit a local bakery and watch how the bread is baked. Write a brief report on your outing.

b. How was bread baked in olden days? Interview a person older than 60 years and write down your findings.

c. What are the similarities and differences on how bread is baked today and how it was done 60 years ago. Explain.

[LO 3.1]

1. DESIGN AND DEVELOP

You are going to use white bread dough and other ingredients to improve the taste of bread. You may also prepare the bread in an interesting shape. You will be given a buttered baking sheet and must bake the bread in the oven.

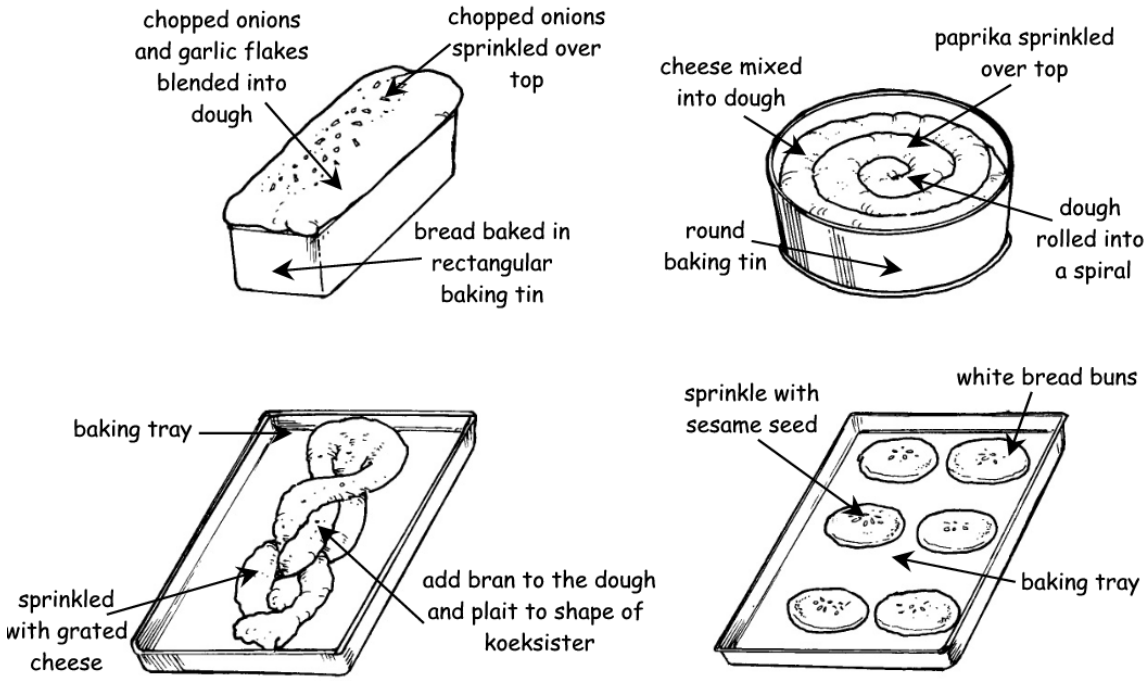

Figure 1.1

Now you must improve your recipe or make notes of your favourite ideas.

1. The shape

Design a few ideas and draw your final idea (see the examples).

[LO 1.5]

1. Write down at least three reasons for your final choice.

Develop your own final idea in detail by drawing it with captions.

1. The name

You have already done research and found interesting names for bread.

Think of a name for your type of bread. Write down a few possibilities and select your final name.

Underline your choice.

Write down two reasons why you have chosen this name. Presentation

How will I present the bread? What will I serve with the bread? (butter, jams, breadboard, butter knife, etc.)? Draw your serving suggestion here and colour it nicely. Add captions.

Hint: First consult recipe books before you begin so that you can get an idea of how it should be done.

[LO 1.12]

1.2.7 Assessment

Learning Outcomes(LOs)

LO 1

TECHNOLOGICAL PROCESSES AND SKILLS

The learner will be able to apply technological processes and skills ethically and responsibly using appropriate information and communication technologies

Assessment Standards(ASs)

We know this when the learner:

1.2 finds out about existing products relevant to a problem, need or opportunity, and identifies and compares their design aspects (e.g. who it is for, what it is for, what it looks like, what it is made of, how well it works, whether it will affect the environment);

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1.4 writes or communicates a design brief for the development of a product related to a given problem, need or opportunity that clarifies the technological purposes of the solution;

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1.8 chooses and uses suitable tools to make products by measuring, marking out, cutting or separating, shaping or forming, joining or combining, and finishing the chosen materials;

1.9 works efficiently and safely;

1.10 evaluates the product according to the design brief and given specifications and constraints (e.g. people, purpose, environmental impact, safety, appearance), and suggests improvements and modifications if necessary;

1.11 evaluates the plan of action followed and suggests improvements and modifications if necessary;

1.12 draws appropriate sketches (e.g. labelled two-dimensional drawings of ideas, enhanced drawings of final solutions and drawings showing measurements) to communicate different information appropriately and effectively.

LO 2

TECHNOLOGICAL KNOWLEDGE AND UNDERSTANDING

The learner will be able to understand and apply relevant technological knowledge ethically and

We know this when the learner:

2.2 demonstrates knowledge and understanding of the reasons for the deterioration of different materials, and ways of preserving them (e.g. drying, coating, canning, sealing).

LO 3
TECHNOLOGY, SOCIETY AND THE ENVIRONMENT
The learner will be able to demonstrate an understanding of the interrelationships between science, technology, society and the environment.
We know this when the learner:
3.1 describes similarities in problems and solutions in own and other societies – past, present and future;
3.2 suggests ways to improve technological products or processes to minimise negative effects on people and/or the health of the environment.

1.2.8 Memorandum

(b) Learners' own ideas.
(c)
1. own ideas and illustrations.
2. own choice.
3. own sketches.

(a) 2

(a) It prevents messing on your clothes.
(b) To allow warm bread to cool down.
(c) Not airtight – preferably in paper while it is still warm, otherwise it becomes "sweaty" and becomes stale sooner. If you want to preserve it for a long time, freeze it.

1.3 Making the bread[3]

1.3.1 TECHNOLOGY

1.3.2 Grade 6

1.3.3 BAKING

1.3.4 Module 3

1.3.5 MAKING THE BREAD

A. MAKING THE BREAD

1. Write down, step by step, your method for transforming the white bread dough and the other ingredients into the final product. Number your procedure and preferably write down only one process per number. If someone else reads it, he/she should also be able to do the same you did.

[LO 1.7]
Actual making process

1. Do you think you can carry out your idea in practice?

Follow your own method carefully and enjoy your baking. Remember to wear an apron.

a) Of what use is an apron?
b) What do you use a cooling tray for? c) Complete the table by writing down all the utensils and ingredients you needed.

[3] This content is available online at <http://cnx.org/content/m22616/1.1/>.

Utensils	Ingredients

Table 1.8

[LO 1.8]

a) What safety measures must be kept in mind when baking bread? Write down as many as you can think of.

[LO 1.9]

B. A BALANCED DIET

What role does bread play in providing in our daily need for food? Bread is a source of carbohydrates that help to give our bodies energy. We must eat only a small piece of bread every day if we do not take part in sport at least twice a week for an hour at a time.

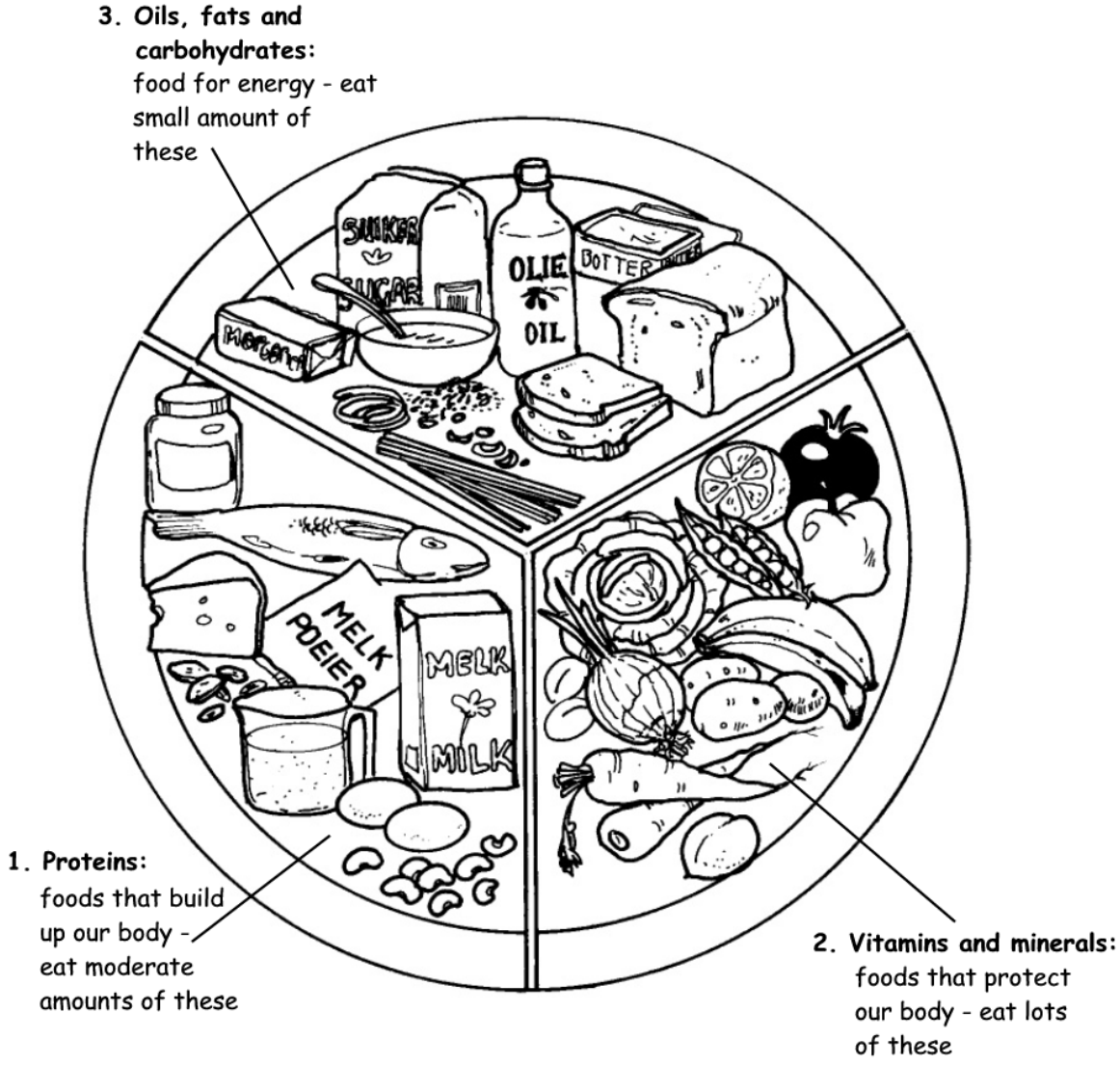

Figure 1.2

A. EVALUATION OF THE BAKING OF BREAD

The smell of freshly baked bread is everywhere. Everyone is hungry, but before you eat you must first complete the questionnaire below honestly.

1. What part of the assignment did you enjoy the most? Why?
2. What part of the assignment did you enjoy the least? Why?
3. What was very easy? Give reasons.
4. What was very difficult? Give reasons. How would you solve the problems?
5. Did you carry out the instructions conscientiously? If not, explain.
6. Did you tidy up after you had placed your bread in the oven? If not, explain.

7. Did you do everything myself? If not, with what parts did you receive help, or was the work divided among your group members?
8. How would you have done it differently? Give reasons.

[LO 1.11]

A. EVALUATING THE FINAL PRODUCT

Now is the time to present your presentation in a practical way. Present the bread in an attractive way on a tray.

1. Which kitchen utensils do you need?
2. Teacher assessment

Answer the following questions by making ticks in the appropriate spaces.

		1	2	3	4
a	Completeness				
b	Attractiveness/appearance				
c	Hygiene				
d	Taste of the bread				
e	Texture of the bread				
Dominant code					

Table 1.9

Hints and suggestions

1. Are you satisfied with the final product? How can you improve?

[LO 1.10]

1.3.6 Assessment

Learning Outcomes(LOs)

LO 1

TECHNOLOGICAL PROCESSES AND SKILLS

The learner will be able to apply technological processes and skills ethically and responsibly using appropriate information and communication technologies

Assessment Standards(ASs)

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1.10 evaluates the product according to the design brief and given specifications and constraints (e.g. people, purpose, environmental impact, safety, appearance), and suggests improvements and modifications if necessary;

1.11 evaluates the plan of action followed and suggests improvements and modifications if necessary;

1.12 draws appropriate sketches (e.g. labelled two-dimensional drawings of ideas, enhanced drawings of final solutions and drawings showing measurements) to communicate different information appropriately and effectively.

Chapter 2

Term 2

2.1 Introduction to three-dimensional objects[1]

2.1.1 TECHNOLOGY

2.1.2 Grade 6

2.1.3 3-d dreams

2.1.4 Module 4

2.1.5 Introduction to three-dimensional objects

You have already been introduced to a variety of two-dimensional shapes: **a square, a rectangle and a circle.**

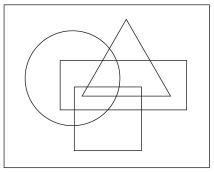

Figure 2.1

[1] This content is available online at <http://cnx.org/content/m22617/1.1/>.

2.1.5.1

2.1.5.2 ASSIGNMENT 1:

2.1.5.3 Look at the sketch below. Can you possibly identify three more two-dimensional shapes except those mentioned above? Use your colouring-pencils and copy the three shapes in three different colours.

2.1.5.4 [LO 1.12]

These shapes are , and .

Let's have a look at the characteristics of these shapes to see if there is a similarity between these figures and the figures above.

2.1.5.5 ASSIGNMENT 2:

2.1.5.6 Write the name/names only of the figure/figures that has/have the characteristic listed below.

2.1.5.7 [LO 1.12]

All four sides are equal in length

a) Has / have four rectangles
b) Has / have two obtuse angles and two acute angles
c) Has / have two long sides and two short sides
d) One pair of opposite sides are parallel
e) Both pairs of opposite sides are parallel
f) The circumference cannot be measured with a ruler

2.1.5.8 ASSIGNMENT 3A:

2.1.5.9 Let's try to draw PARALLELOGRAMS and RHOMBUSES. For this you need a 30°/ 60° grid (annexure 1)

2.1.5.10 [LO 1.12]

Place the grid under the page, turn the page sideways and draw a parallelogram of 50 mm by 30 mm. Can you draw the parallelogram in at least two different ways?

2.1.5.11 ASSIGNMENT 3B:

2.1.5.12 Using the 30°/ 60° grid, draw a rhombus of which each of the sides is 40 mm. Try to do it in two different ways.

2.1.5.13 [LO 1.12]

Background:

When we connect lines, **flat planes** or **shapes** are formed. When we connect four or more flat planes, we have a three-dimensional object.

If you put six squares together, you will find a kind of box, which we call a CUBE. A **cube** has three dimensions, namely **length, breadth and height**. A cube has six planes.

Please Note:

The sides of the cube that we cannot see are indicated by a broken line (dotted line). Remember that the broken lines must always meet at the angles

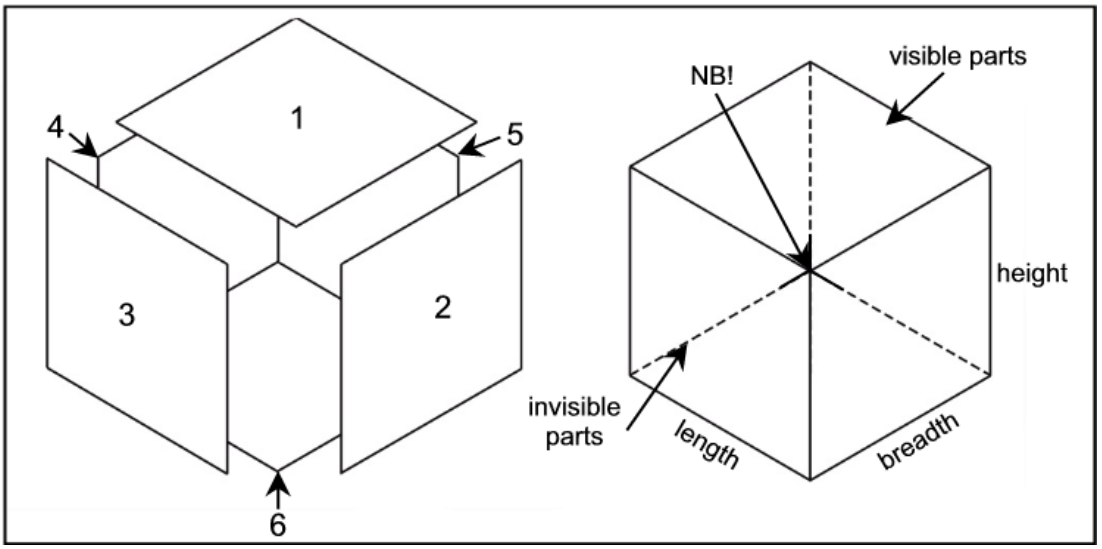

Figure 2.2

ASSIGNMENT 4A:

Try to draw your own cube, using the 30°/ 60° grid. Indicate the broken lines. Let your friends help you if you find it difficult.

[LO 1.12]

Suggestion:

Each side covers five squares.)

Figure 2.3

Which popular object that we use when we play board games has the shape of a cube?

Complete the word: A d e.

Can you think of more examples?

Background:

If we put four rectangles of the same size and two rectangles of a smaller size together, we will find a shape that looks like a brick or a shoebox. This shape also has three dimensions, namely length, breadth and height. The shape also has six planes.

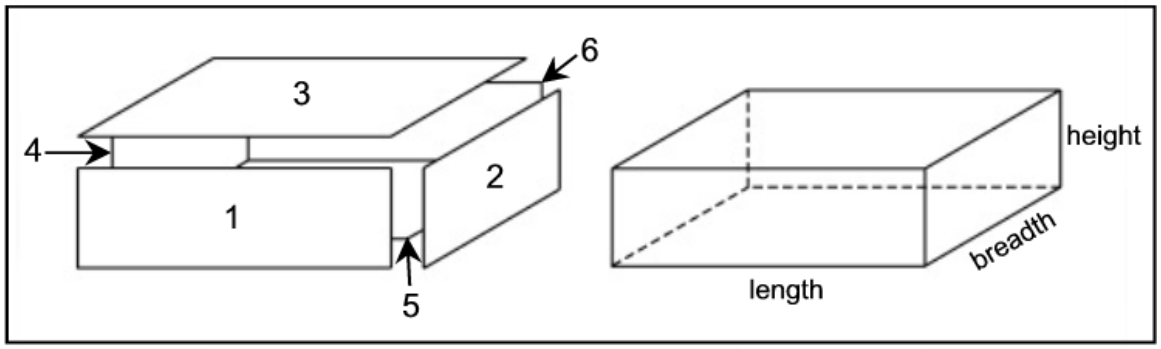

Figure 2.4

2.1.5.14 ASSIGNMENT 4B:

2.1.5.15 Try to draw your own brick by using the 30 °/ 60 ° grid. Also indicate the broken lines. Suggestion: length: 60 mm, breadth: 40 mm, height: 30 mm.

2.1.5.16 [LO 1.12]

Suggestion:

Length: 60 mm, breadth: 40 mm, height: 30 mm.

Background:

Other three-dimensional shapes are a cylinder, for example the cardboard tube of a toilet roll; a sphere, for example a soccer ball; a pyramid, for example the roof of a simple square-shaped house; and a cone, for example the ice-cream cone you get when you buy yourself a soft-serve ice-cream.

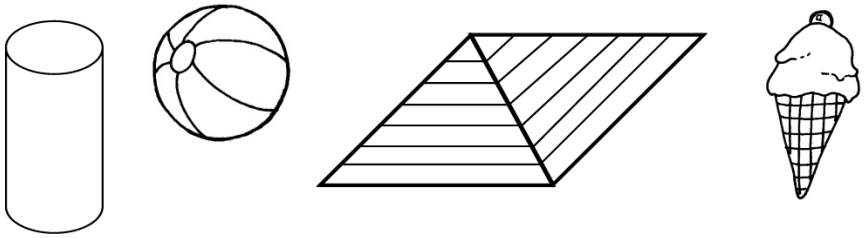

Figure 2.5

ASSIGNMENT 5:

Make free-hand drawings of examples of each of the above-mentioned three-dimensional shapes. [LO 1.12]

2.1.6 Assessment

Learning Outcomes(LOs)

LO 1

TECHNOLOGICAL PROCESSES AND SKILLS

The learner will be able to apply technological processes and skills ethically and responsibly using appropriate information and communication technologies

Assessment Standards(ASs)

We know this when the learner:

1.12 draws appropriate sketches (e.g. labelled two-dimensional drawings of ideas, enhanced drawings of final solutions and drawings showing measurements) to communicate different information appropriately and effectively.

2.1.7 Memorandum

Assignment 1

Learners could recall knowledge already gained in MLMMS and apply it here.

Assignment 2

Learners may discuss answers in groups and fill them in. The teacher could then check. NB All sketching to be done in pencil.

Assignment 3A and B

This is a practical exercise. Learners may help each other. One line on the 30-60 grid represents 1cm/10mm. The teacher could make a transparency of the grid and explain it to the learners that way.

Assignment 4A and 4B

Let learners help each other and explain to each other.

Assignment 5

Bring examples or get learners to bring examples of a cylinder, a sphere, a pyramid and a cone to school so that it will be easier to draw

2.2 An isometric drawing of a cube[2]

2.2.1 TECHNOLOGY

2.2.2 Grade 6

2.2.3 3-D DREAMS

2.2.4 Module 5

2.2.5 AN ISOMETRIC DRAWING OF A CUBE

2.2.5.1 ASSIGNMENT 1:

2.2.5.2 Answer the following questions that are related to the ISOMETRIC DRAWING of a cube.

2.2.5.3 [LO 1.3]

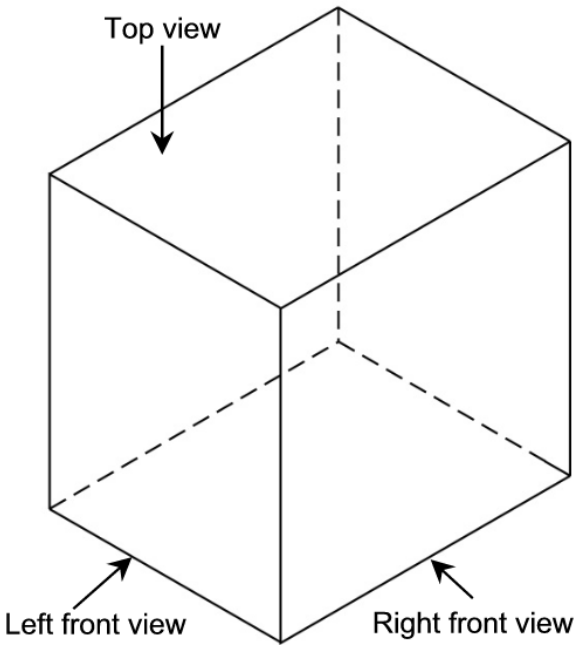

Figure 2.6

a) How many **visible** (continuous) lines are there in the drawing?
b) How many **invisible** (broken) lines are in the drawing?
c) How many **planes** does the figure have?
d) How many planes are visible?
e) How many planes are invisible?

Underline:

[2]This content is available online at <http://cnx.org/content/m22618/1.1/>.

a. A cube is made up of six (squares, rectangles) but in the sketch they look like six (parallelograms, rhombuses).
b. This cube has three views, namely a FRONT VIEW (right front), a SIDE VIEW (left front) and a TOP VIEW (from right above).

Colour the views in the following way: Front: Blue
Side: Green
Top: Red

2.2.5.4 ASSIGNMENT 2A:

2.2.5.5 Colour the figures below by making use of the above-mentioned colours. Try to draw the invisible lines of each cube.

2.2.5.6 [LO 1.3]

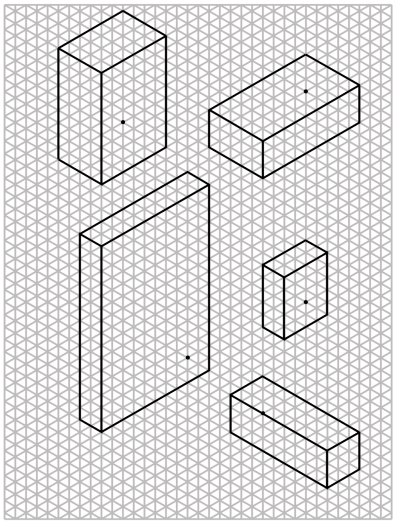

Figure 2.7

2.2.5.7 ASSIGNMENT 2B:

2.2.5.8 Draw similar shapes as in Assignment 7A on a 30°/ 60° grid. (The figures are placed differently each time.)

2.2.5.9 [LO 1.3]

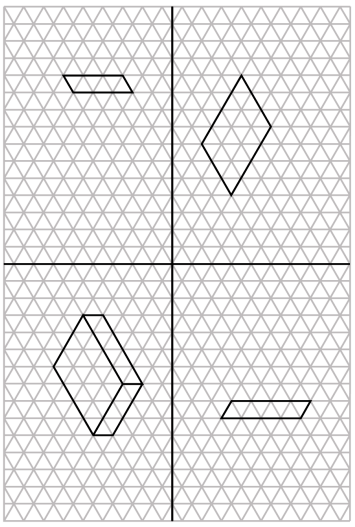

Figure 2.8

Background:

Before we try individually to draw a three-dimensional object, we are going to compare shapes of planes in a drawing with shapes of the real object.

2.2.5.10 ASSIGNMENT 3:

2.2.5.11 Study the following drawings and identify the shapes that are required.

2.2.5.12 [LO 1.3]

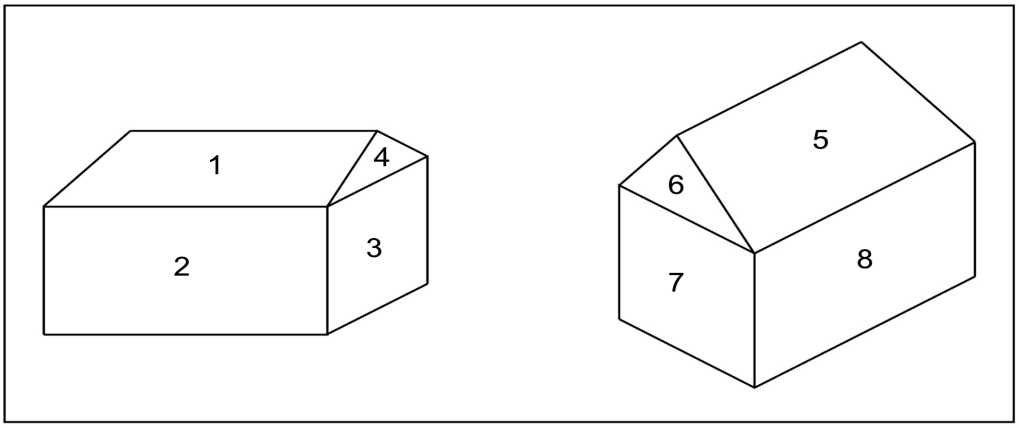

Figure 2.9

Drawing A and B

- Complete the table:

Number of plane	Type of face on sketch	Shape on real object
1		
2		
3		
4		
5		
6		
7		
8		

Table 2.1

Something interesting:

- Do your answers to 2 and 8 differ on the sketch?

If we suppose that these are sketches of the same shed, try to explain why.

- Do your answers regarding planes 2 and 8 differ on the real object?
- Explain

Background:
A three-dimensional shape such as a cube also has **vertical** and **horizontal** planes.

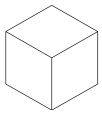

Figure 2.10

Circle:
A cube has 2/ 4/ 6 horizontal and 2/ 4/ 6 vertical planes.
[LO 1.3]
ASSIGNMENT 4A:

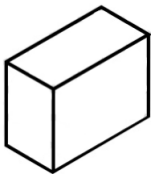

Figure 2.11

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a) How many horizontal planes does a wooden block have that stands like this?
And vertical planes?

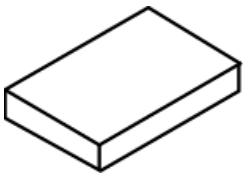

Figure 2.12

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b) How many horizontal planes does a wooden block have that stands like

this?
And vertical planes?
c) What conclusion can you draw from this? Complete:
A wooden block/rectangular shape always has horizontal and vertical planes.

2.2.5.13 ASSIGNMENT 4B:

2.2.5.14 [LO 1.3]

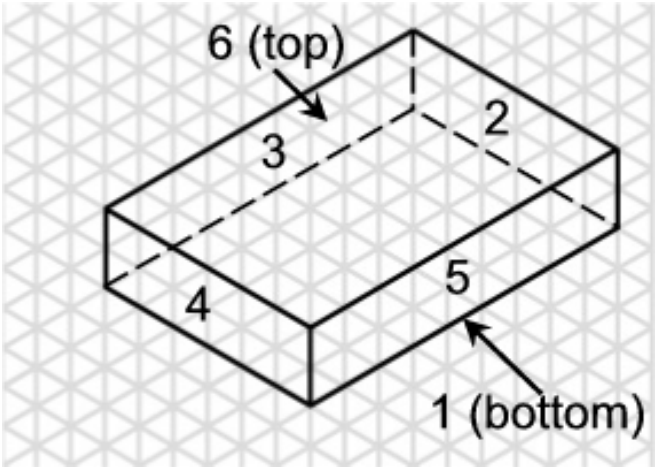

Figure 2.13

a) Redraw the three visible planes on carbon paper (numbers 4, 5 and 6 above).
b) Cut out the three planes.
c) Use three pieces of different coloured cardboard and cut out two examples of each plane from the colours (six parts with two of each colour) (two of number 6, two of number 5, two of number 4).
d) Build the box on the grid (annexure 1) by gluing the parts as shown in the sequence that was indicated above. Use Prestik to stick the parts onto the grid.
e) Now draw the box in pencil on the grid. First draw the visible lines and then the invisible lines in dotted lines.
A Challenge:
f) Suppose that plane 4 is a flap that can open. Close flap 4. Now draw the box in pencil with its open flap on the grid. First draw all the visible lines and then the invisible lines.

2.2.6 Assessment

Learning Outcomes(LOs)
LO 1
TECHNOLOGICAL PROCESSES AND SKILLS
The learner will be able to apply technological processes and skills ethically and responsibly using appropriate information and communication technologies

Assessment Standards(ASs)

We know this when the learner:

1.3 performs, where appropriate, scientific investigations about concepts relevant to a problem, need or opportunity using science process skills.

2.2.7 Memorandum

Assignment 1

Learners could do it individually after a learning discussion by the teacher.

Assignment 2A

The teacher could do one together with the learners in order to explain it to them, and the learners could then do the rest individually. Make a transparency of the page and use coloured transparency pens.

Assignment 2B

The teacher explains, using a cigarette box or matchbox. The different positions are then indicated in a practical way before the learners draw it. For instance, B could be done with the learners, and then they could be told to do C and D by themselves.

Assignment 3

Let groups of learners, for instance, do drawing A. They should then check and the reasons for the answers. Then learners should do drawing B individually, after which it could be checked. Have a class discussion about the relevant questions.

Assignment 4A

Discuss the questions by illustrating practically with a wooden block and let learners fill in the answers.

Assignment 4B

This is a practical exercise. Each learner should therefore have scissors, Prestik, a 30 60 grid (Addendum 1) and three pieces of coloured cardboard to complete the assignment. Do the assignment together with the learners.

Assignment 5

Each learner can evaluate his/her progress individually. Emphasise the fact that each learner should be honest, as the teacher would be able to see from the practical work whether the learner was honest or not.

2.3 Drawing a three-dimensional figure without a grid[3]

TECHNOLOGY

Grade 6

3-D DREAMS

Module 6

Drawing a three-dimensional figure without a grid

You must now learn to draw a three-dimensional figure without a grid. One way is to draw a three-dimensional figure in perspective by making use of disappearing lines of vision on the horizon.

Background:

Lines that are further away from our field of vision, tend to have the following qualities:

It seems as if parallel lines move closer until they meet on the horizon. (Think of the Karoo road.)

[3]This content is available online at <http://cnx.org/content/m29587/1.1/>.

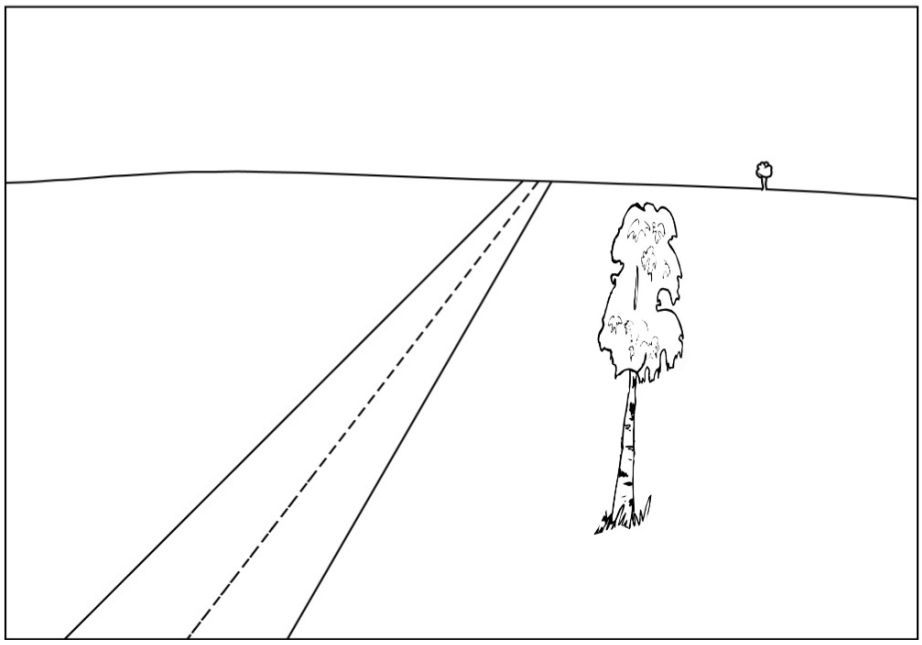

Figure 2.14

Horizontal lines of the same length seem to become shorter the further they are from us.

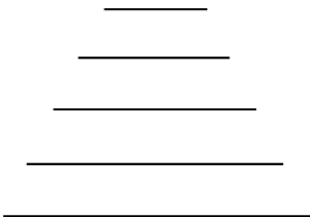

Figure 2.15

Objects of the same size look smaller the further away they are from us.

Figure 2.16

HOW TO DRAW AN ELEMENTARY CUBE IN PERSPECTIVE

Figure 2.17

Draw a square.

2. Draw a horizontal line above (if you want to see the top) or in the middle (if you want a front view) or under the square (if you want to see the bottom).

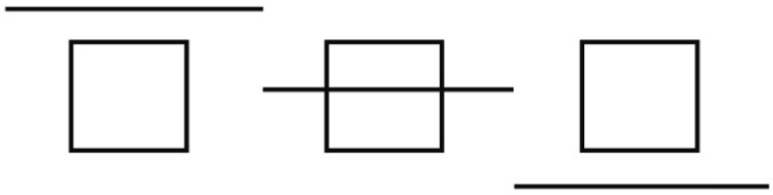

Figure 2.18

3. Mark the vanishing point somewhere on the horizontal line. If it is to the right of the square, you will see the right view; left of the square you will see the left view.

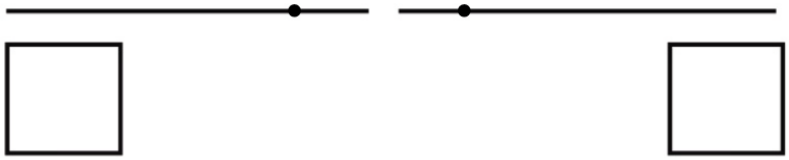

Figure 2.19

4. Draw faint lines from each outer corner of the square to the vanishing point.

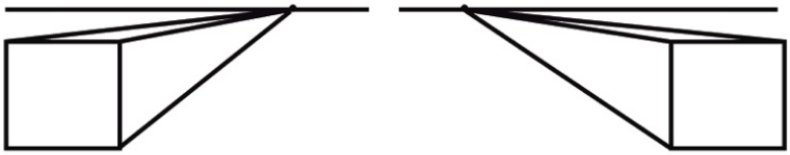

Figure 2.20

5. Complete the cube by drawing the rear side of the shape. The lines of the sides near the vanishing point are shorter than the actual front sides of the square but they run parallel to the front sides. The sides facing the disappearing point are also shorter.

Figure 2.21

6. Erase the horizontal line, the vanishing point and the lines facing the vanishing point. Make all the visible lines of the cube darker. Now you have your cube.

Figure 2.22

ASSIGNMENT 1:
Complete the following cube (30 mm by 30 mm) so that you can see the left view.
[LO 1.12]
Challenge:
Now try to draw it with the vanishing point on the right side of the cube.
Another method is, to make use of the oblique view method at an angle of 45 °. (An oblique view is a three-dimensional drawing of which the sightlines are at an angle of 45 °).
HOW TO DRAW AN OBLIQUE VIEW CUBE:

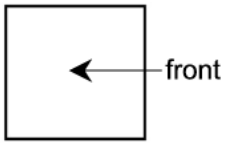

Figure 2.23

1. Draw a square.
2. Draw the side view and top view by drawing a 45 ° angle at every point (visible outer angle) from the horizontal. (The angles all lie to the left.)

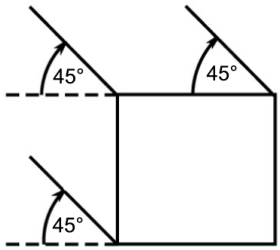

Figure 2.24

3. Measure the length of a side of the square (front view). Determine the length of the 45 ° sides by measuring half of the original length.

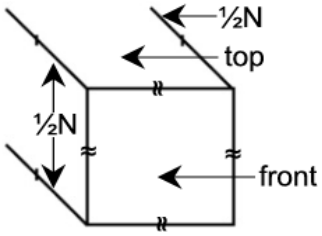

Figure 2.25

4. Connect the points to complete the back of the cube. Erase all the unnecessary lines and redraw the lines of the cube with darker lines.

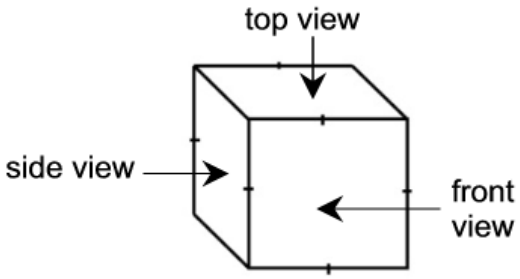

Figure 2.26

ASSIGNMENT 2:

Draw a cube of which each of the sides on the front view is 40 mm. Also use a protractor or a set square of a 45 ° angle (oblique view method).

[LO 1.12]

Challenge:

Also try to draw a cube with a 45 ° angle to the right.

ASSIGNMENT 3A:

Draw a three-dimensional figure of a square according to each of the two above-mentioned methods:

[LO 1.12]

a) with the vanishing point to the right on the horizon;

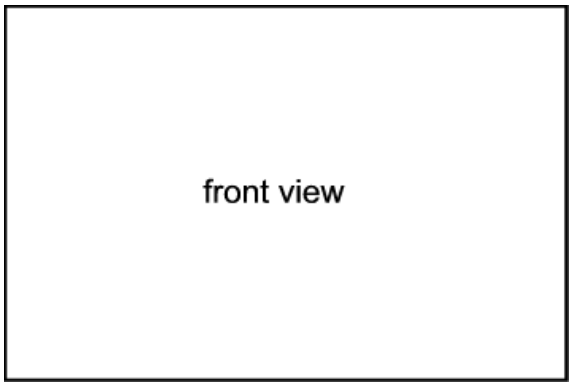

Figure 2.27

b) oblique view at 45 ° using a ruler and protractor (the angles all lie to the right) (breadth: 40 mm).

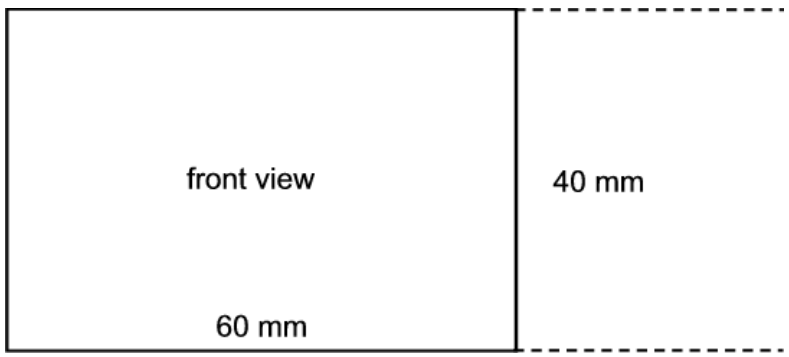

Figure 2.28

ASSIGNMENT 3B:
[LO 1.12]

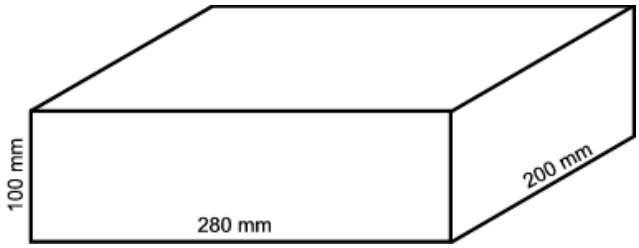

Figure 2.29

Challenge:

The correct measurements of a shoe box are as follows:

A Length: 280 mm

B Breadth: 200 mm

C Height: 100 mm

Reduce it four times ACCORDING TO SCALE so that you can redraw it in the space below according to the oblique view method.

According to scale: Length:

Breadth:

Height:

Hint:

First draw it as a brick and then adjust it by drawing in the detail of the shoebox. Colour it (according to the example provided) and indicate the actual measurements on it next to each side.

Background:

In both of the above-mentioned methods, in order to draw a three-dimensional object, one of the views/planes is turned to the front. With ISOMETRIC drawings, one angle of the figure is turned to face the front.

What is an isometric drawing?

It is a three-dimensional drawing of which the visible lines (the lines that can be seen) are at an angle of 30 °.

HOW DO YOU DRAW AN ISOMETRIC CUBE?

1. Draw a broken line in the middle of a given space.

Figure 2.30

2. Set a point on the line that will indicate the top of the cube.

Figure 2.31

3. Mark two 30 ° angles on both sides of the point with the horizontal at the top of the broken line.

Figure 2.32

4. Draw a vertical side downwards according to the length of one side of the cube.

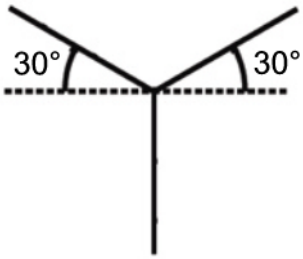

Figure 2.33

5. Measure the top two sides to be the same length.
6. Draw a dotted line at the bottom parallel to the top one and measure 30 ° angles to the top at both sides.

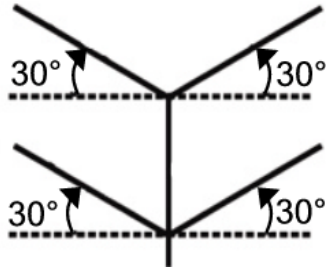

Figure 2.34

7. Draw these lines so that they are the same length as the vertical side.

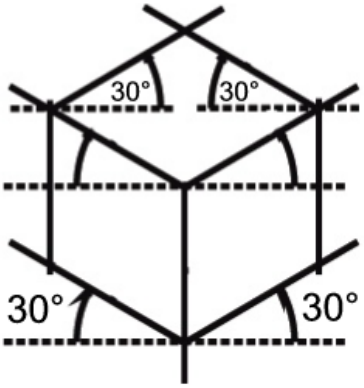

Figure 2.35

8. Draw the two vertical parallel lines on both sides of the centre line.
9. Draw a broken line to connect the two upper angles. Measure 30° at the top from the horizontal on both sides and extend the lines so that they cross. Thus the top view is achieved.

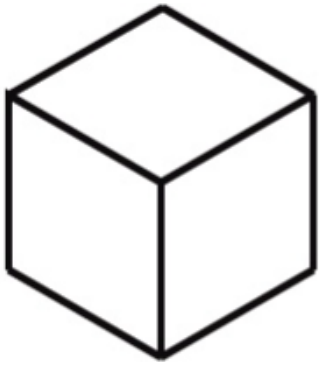

Figure 2.36

ASSIGNMENT 4:

Draw an isometric cube of which the sides are 50 mm. Use a ruler, pencil and protractor of 30° or a set square.

[LO 1.12]

Challenge:

ASSIGNMENT 5:

Draw a rectangular figure (a wooden block) of which the length is 80 mm, the breadth 30 mm and the height 40 mm.

[LO 1.12]

Remember:

All vertical sides remain vertical, but the oblique lines are 30° from the horizontal.

Assessment

Learning Outcome 1

TECHNOLOGICAL PROCESSES AND SKILLS

The learner will be able to apply technological processes and skills ethically and responsibly using appropriate information and communication technologies

Assessment Standard

We know this when the learner:

1.12 draws appropriate sketches (e.g. labelled two-dimensional drawings of ideas, enhanced drawings of final solutions and drawings showing measurements) to communicate different information appropriately and effectively.

2.4 Let's make small clay box[4]

2.4.1 TECHNOLOGY

2.4.2 Grade 6

2.4.3 3-D DREAMS

2.4.4 Module 7

2.4.5 Let's make a small clay box

Case study for a boy

During each break at school, you play marbles and you are becoming very skilful.

Every day you won beautiful large shooting marbles, which you showed, proudly to your dad at home. You did not take these prized possessions back to school, because you were afraid you would lose them. Unfortunately you forgot to put them in a safe place. Then one afternoon your mom spoke to you for the third consecutive day, because you had forgotten to take your marbles out of the pockets of your school trousers and they had landed in the washing machine. Your mom was very distressed because she had to call the plumber to see to the washing machine again. She warned you to get a container for your marbles, otherwise she would quietly make them disappear. You decided that this container would not be just an ordinary empty plastic bag, a glass, peanut butter jar or an empty coffee tin.

Case study for a girl

It is already difficult to get up early for school in the winter, but if your hair elastics are always missing, especially when you are already late, it becomes necessary to make a plan. You regularly miss the school bus and then your mom has to take you to school in the old farm truck. You decide to design and make yourself a container that you can put on your dressing table next to your hairbrush, in which you can put your hair elastics the moment you remove them from your hair. You have a lovely big dam on the farm where you can find lots of clay. You want to make a container from clay.

1. Research

2.4.6 ASSIGNMENT 1:

a) What is the need?

b) Write down a clear and short design proposal for your product.

I am going to design and make a (what)
to use at the so that I can put my (what)
in it.

[LO 1.4]

c) Specifications for the design and manufacturing of the product.

SPECIFICATIONS FOR THE DESIGN AND MANUFACTURING	
1. The shape/figure	A cube with a loose fitting lid
2 The size	Sides of more or less 10 cm each with each edge 5 mm thick
3 Materials used	Modelling clay
4 Finishing	Creative designs on the outside
5 Durability	Handle carefully because it can break
6 Safety	Use modelling knife carefully

[4]This content is available online at <http://cnx.org/content/m22623/1.1/>.

Table 2.2

2. Design
Background
The five principles for a successful design is that the product must have a PURPOSE, an interesting APPEARANCE, will be made from a suitable MATERIAL and that it will be sturdily MANUFACTURED so that it will have a positive INFLUENCE on the user and the environment.

2.4.7 ASSIGNMENT 2A:

2.4.8 Design the container for your hair elastics / marbles by making an isometric drawing of the container without the lid. Draw many designs. See that you have a frame of approximately 20 cm by 20 cm in which you can draw the designs.

2.4.9 [LO 1.5]

2.4.10 ASSIGNMENT 2B:

2.4.11 Circle the best idea. Remember the labels.

2.4.12 [LO 1.6]

Requirements:
You are going to make six loose tiles that you can join. You must decorate the outside of the container in a creative and original way by pressing small objects such as screws, needles and paper clips into the soft clay, or by etching patterns into it with a kebab stick. Thus you are going to decorate only four planes in the same way.

2.4.13 ASSIGNMENT 3:

2.4.14 Now draw designs in the rectangles below to indicate how you want to decorate your container in order to give it texture. Circle your best idea.

2.4.15 LO 1.6]

2.4.16 ASSIGNMENT 4:

2.4.17 Which tools / equipment will you use to make the pattern you have chosen? Get the tools together and bring them to school.

2.4.18 [LO 1.8]

1. Requirements
The lid of your container must fit firmly on the container. There must also be a handle by which you can lift the lid.

2.4.19 ASSIGNMENT 5:

2.4.20 Make a freehand design of the lid showing a three-dimensional top view and bottom view. Circle your best idea.

2.4.21 [LO 1.5]

Top views
Example:

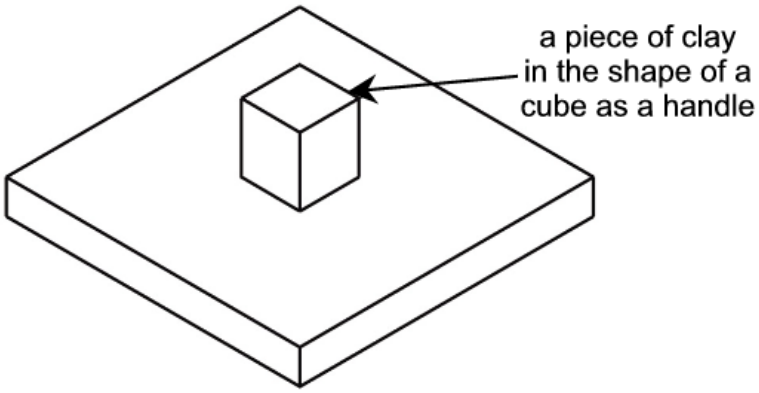

Figure 2.37

Bottom view
Example:

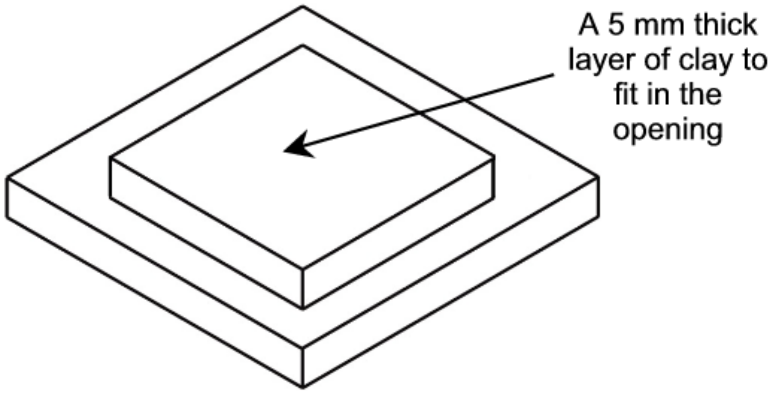

Figure 2.38

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2. Manufacturing

2.4.22 ASSIGNMENT 6:

2.4.23 Plan and make

2.4.24 [LO 1.5]

a) What kinds of tools do you require to roll out the clay to a thickness of 5 mm? (Choose from: wooden board, clay knife, rolling pin, and cake flour)

- a to roll out the clay smoothly.
- a to flatten the clay.

- a to scrape the dough from the rolling pin and wooden
board.
- so that the clay does not stick to the rolling pin or board.

b) Measure out a square tile on a piece of cardboard with sides of 10 cm and cut it out. This will be your TEMPLATE. Place the template on the rolled out clay and cut six tiles from the clay. Also use the modelling knife to make yourself a handle and the bottom of your lid.

Now decorate the vertical planes of your container (4 tiles).

Cut 5 mm from both left and right sides of the two vertical tiles. Roughen the edges with a kebab-stick. You may also use water.

Working very carefully, join the different parts of the container in the following way:

- Put the tile that will be at the bottom, on a large greased baking pan.
- Use a kebab-stick and roughen 1 cm of the edges all around.
- Place the decorated tiles upright on the bottom part. Ensure that the edges join properly and that the edges form proper rectangles.
- Place the container where it can dry properly. If the clay can be baked, it may be baked in the oven according to the instructions.
- Complete your lid according to your design and put it next to your container.
- As soon as your container and lid have dried and have cooled down, you may paint it in one colour with poster paint. Then you can varnish it in a transparent varnish so that the article is sealed and the colour of the paint that you used can show up.

Interesting!

As early as the Stone age (12000 BC), when people made utensils and weapons from stone and bone, they started to manufacture utensils from clay, mainly to store food and water. Clay is a very old substance that was used to manufacture utensils and jewellery People used it because clay was readily available.

During the Bronze age (3000 BC) people started to melt metals so that they could make utensils and weapons. In those days people made many articles that were used daily, such as containers, mugs, pots, etc, from clay. They also made bricks and tiles from clay and built houses with the clay bricks. Archaeologists, who excavate antique civilisations, frequently find many objects and relics of clay, which prove that this is true.

Nowadays clay and sand are fired in a furnace after ceramic objects such as crockery (plates, cups, and saucers) have been made from it. Ceramic objects are not only used in the preparation of food, but also in the building trade.

Clay is an example of a natural substance, i.e. a raw material that is provided by nature and has a mineral origin. Natural substances can also have a vegetative origin, e.g. cotton, and an animal origin, e.g. wool or silk.

When clay is baked in the sun to dry, it is known as earthenware. Long ago, people who lived in hot countries, allowed the pots to bake in the sun. In colder countries earthenware was baked in a wood fire.

2.4.25 ASSIGNMENT 7:

2.4.26 Visit a brickfield or pottery factory in your area. Describe the processes through which the clay must go right from its natural state, up to its final, processed form. Use a flowchart.

2.4.27 [LO 1.12]

Take Note

Consult a reference source in case a visit to a brickfield or pottery factory is impossible. Write each new activity of the process in a separate space and make sure that the activities have been arranged in a logical sequence.

Did you know?
Pottery is a traditional activity of the indigenous peoples of Africa.

2.4.28 ASSIGNMENT 8:

2.4.29 Consult any reference source and write a paragraph on any points of interest about this tradition, for example what role this tradition played in the economic and cultural lives of African peoples and what role it still plays today.

2.4.30 [LO 3.1]

2.4.31 ASSIGNMENT 11:

2.4.32 What do other people think of your container? Ask at least five people to give their honest opinion about your container. The people must not be your class friends, and three must be adults.

2.4.33 [LO 1.10]

2.4.34 ASSIGNMENT 12:

2.4.35 Display your container in the school's foyer. Print your name, surname and class section clearly on a card and put it next to your container. Perhaps the principal will order a jewellery box from you!

2.4.36 Assessment

Learning Outcomes(LOs)
LO 1
TECHNOLOGICAL PROCESSES AND SKILLS
The learner will be able to apply technological processes and skills ethically and responsibly using appropriate information and communication technologies
Assessment Standards(ASs)
We know this when the learner:
1.4 writes or communicates a design brief for the development of a product related to a given problem, need or opportunity that clarifies the technological purposes of the solution;
1.5 suggests and records at least two alternative solutions to the problem, need or opportunity that link clearly to the design brief and to given specifications and constraints (e.g. people, purpose, safety, environmental impact, appearance);
1.8 chooses and uses suitable tools to make products by measuring, marking out, cutting or separating, shaping or forming, joining or combining, and finishing the chosen materials;
1.10 evaluates the product according to the design brief and given specifications and constraints (e.g. people, purpose, environmental impact, safety, appearance), and suggests improvements and modifications if necessary;
1.12 draws appropriate sketches (e.g. labelled two-dimensional drawings of ideas, enhanced drawings of final solutions and drawings showing measurements) to communicate different information appropriately and effectively.
LO 3
TECHNOLOGY, SOCIETY AND THE ENVIRONMENT
The learner will be able to demonstrate an understanding of the interrelationships between science, technology, society and the environment.
We know this when the learner:
3.1 describes similarities in problems and solutions in own and other societies – past, present and future;

2.5 Introduction to frame structures[5]

2.5.1 TECHNOLOGY

2.5.2 Grade 6

2.5.3 STRUCTURES

2.5.4 Introduction to frame structures

2.5.5 Assignment 1:

2.5.6 What is a frame structure?

2.5.7 [LO 2.2]

It consists of which are connected to construct a .
Support is often provided from the .
Thus the frame is sometimes hidden by a .

- A bridge or tower, such as a windmill, is a good example of a frame structure.

[5] This content is available online at <http://cnx.org/content/m22624/1.1/>.

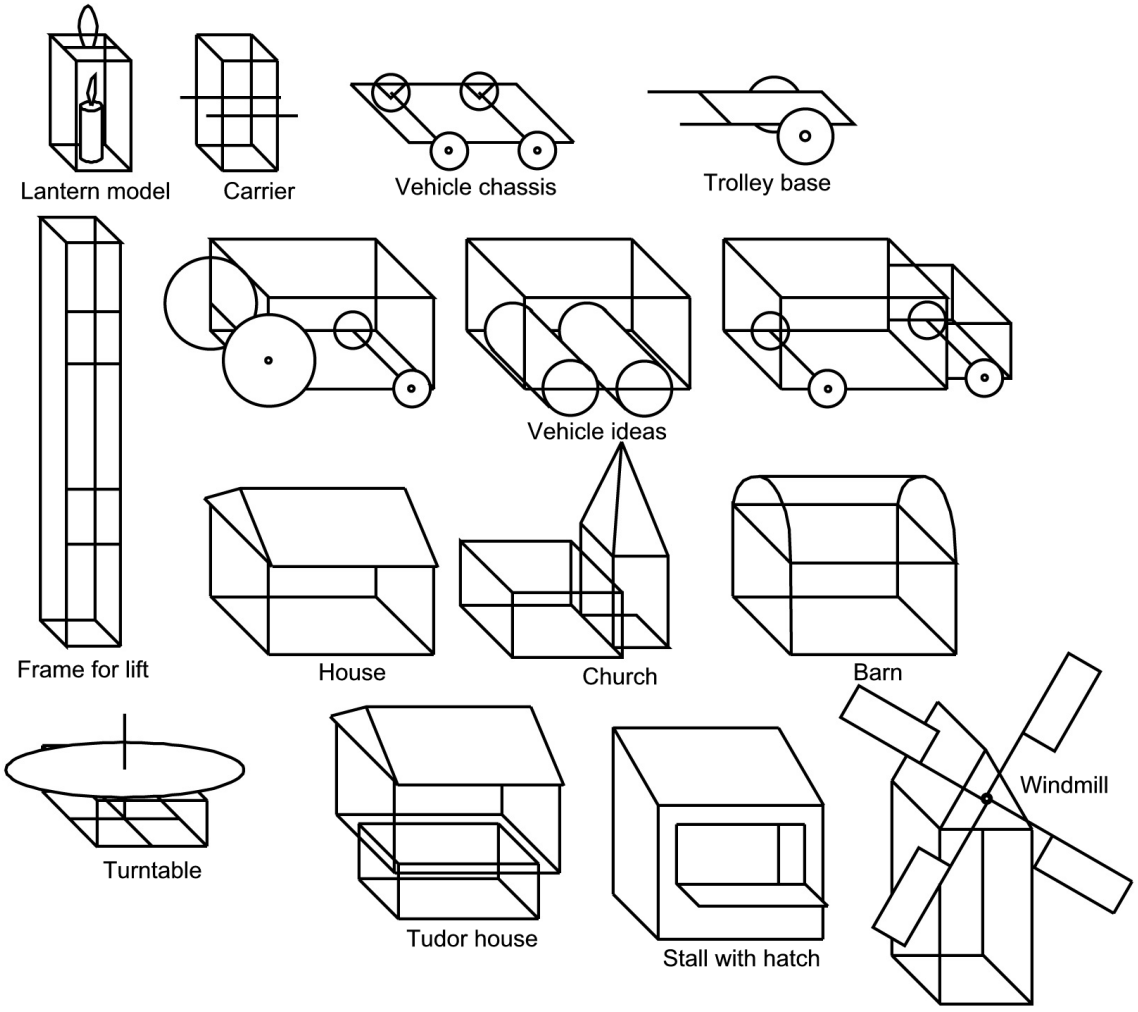

Figure 2.39

2.5.8 Assignment 2:

2.5.9 Let's make paper straws to use for a frame structure. Use old sheets of A4 paper, a thin dowel / long pencil and wood glue.

2.5.10 [LO 1.8]

Instructions:

a. Fold a sheet of paper to form a square. Cut off the remaining part.

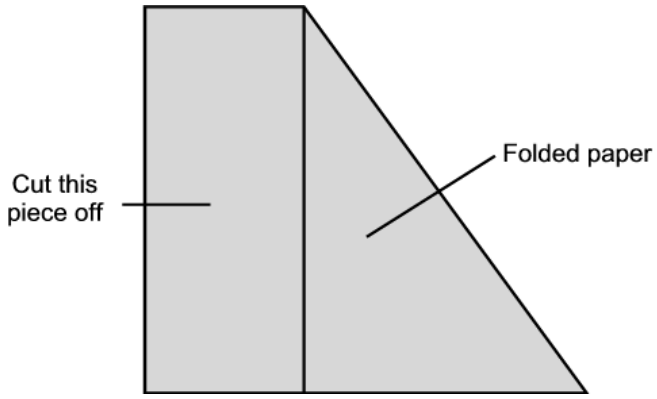

Figure 2.40

b. Roll the paper around a pencil / dowel by starting at one corner of the square and ending at the opposite corner.

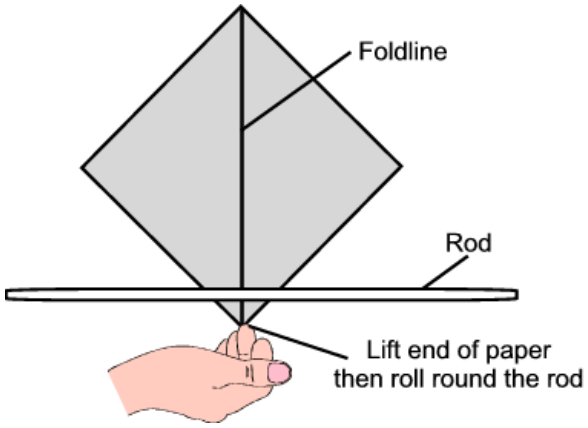

Figure 2.41

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c. Roll the paper tightly around the pencil on a flat surface.

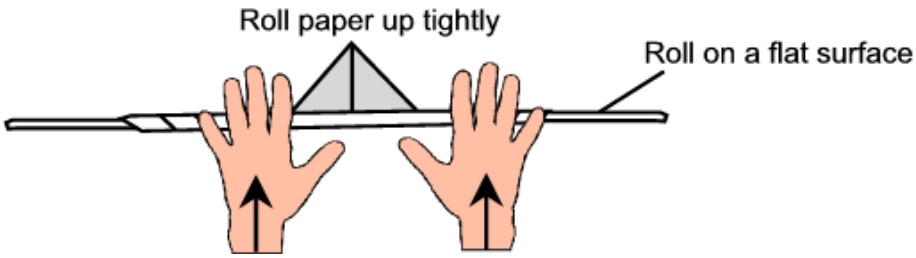


Figure 2.42

d. Apply paper glue to the end of the paper and stick it down firmly.

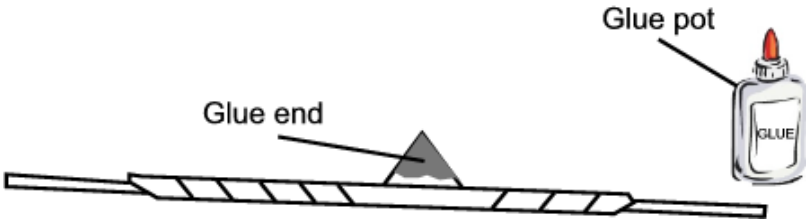


Figure 2.43

e. Remove the dowel from the straw by turning it slightly and pulling it out gently.

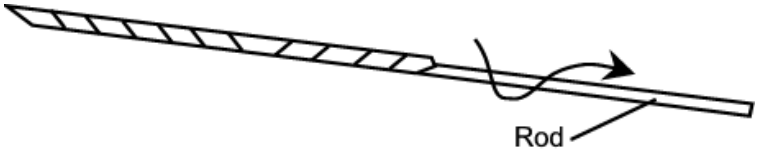


Figure 2.44

2.5.11 Assignment 3:

2.5.12 Let's practise joining paper straws. There are different methods.

2.5.13 [LO 1.2, 1.8]

Method 1:

In order to obtain a longer straw, you can push the one end of the straw into the opening of the other while turning it. Use a little glue to join it properly.

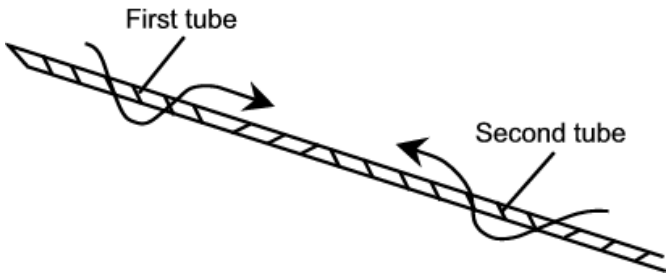


Figure 2.45

Method 2:
Use a glue gun to glue the corners quickly and firmly.
Method 3:
a. Measure the required length of the straws. Cut them neatly and straight by using a pair of scissors.

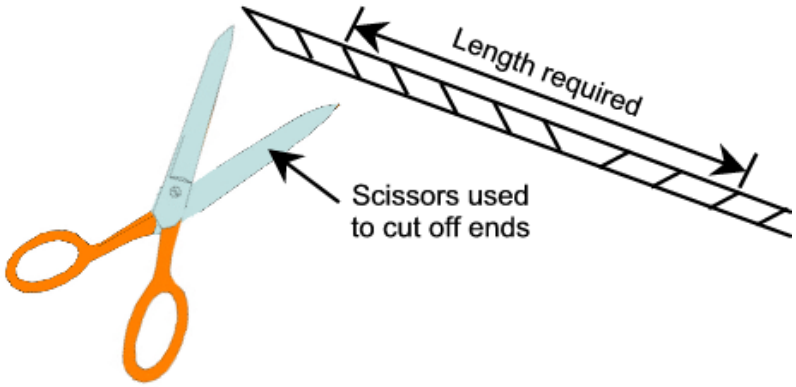


Figure 2.46

b. Flatten the sides by pressing them down with a hammer or with your hand and then mark where the holes should be made.

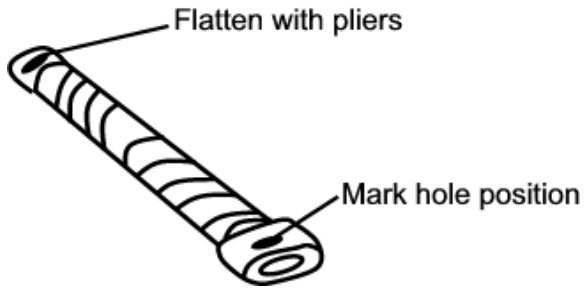


Figure 2.47

c. Use the punch to make holes and connect the straws by using hole studs or rivets.

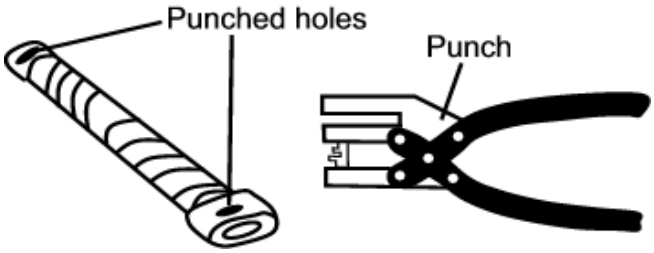


Figure 2.48

Method 4:
Use short pieces of bent pipe cleaners. Glue them firmly.

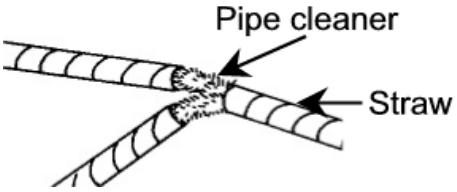


Figure 2.49

Background
Before you design and make your own bridge, we are going to examine different kinds of bridges.

What is a bridge?
It is a structure that spans a distance and that can also support certain things.

- From the earliest times, man built bridges to link inaccessible areas in order to get somewhere. The GIRDER BRIDGE is the first and simplest type of bridge. The simplest example consists of one beam that rests on two areas on either side in order to link the two areas.

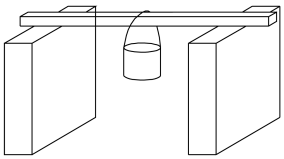


Figure 2.50

[LO 1.2]

Long ago people built girder bridges from stone, but they could only cover short distances. Today reinforced concrete beams, wood or steel are used to cover longer distances. Sometimes the beams are supported from below by one or more columns.

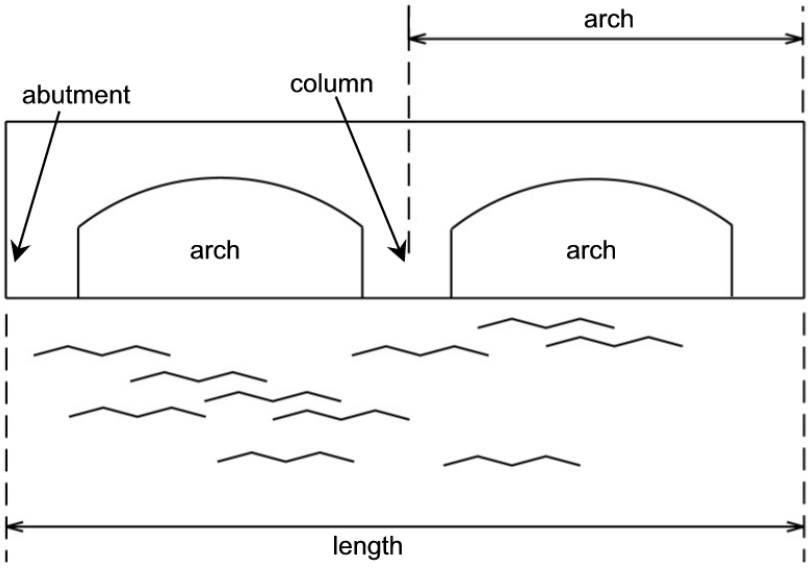


Figure 2.51

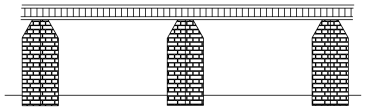


Figure 2.52

When a girder bridge is reinforced by means of a framework of rods in a triangular shape above or below the beam, such a bridge is called a TRUSSED BRIDGE. Bridges across railway lines are sometimes constructed in this way.

Figure 2.53

A Trussed bridge

AN ARCHED BRIDGE is built when deep ravines and rivers must be crossed and when it is impossible to erect shafts. The arch is built above or below the beam to enforce it and stretches from one bank to the other.

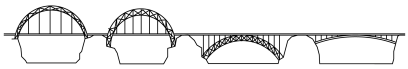


Figure 2.54

An Arched bridge

A SUSPENSION BRIDGE is built to span great distances. The road is literally suspended by very strong steel cables that are anchored to towers.

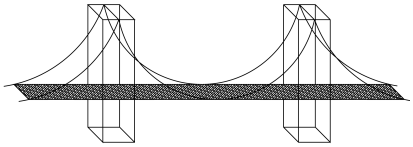


Figure 2.55

A Suspension bridge

2.5.14 Assessment

Learning Outcomes(LOs)

LO 1

TECHNOLOGICAL PROCESSES AND SKILLS

The learner will be able to apply technological processes and skills ethically and responsibly using appropriate information and communication technologies

Assessment Standards(ASs)

We know this when the learner:

1.2 finds out about existing products relevant to a problem, need or opportunity, and identifies and compares their design aspects (e.g. who it is for, what it is for, what it looks like, what it is made of, how well it works, whether it will affect the environment);

1.8 chooses and uses suitable tools to make products by measuring, marking out, cutting or separating, shaping or forming, joining or combining, and finishing the chosen materials;

LO 2

TECHNOLOGICAL KNOWLEDGE AND UNDERSTANDING

The learner will be able to understand and apply relevant technological knowledge ethically and

We know this when the learner:

2.2 demonstrates knowledge and understanding of the reasons for the deterioration of different materials, and ways of preserving them (e.g. drying, coating, canning, sealing).

2.6 Design a basic frame structure[6]

2.6.1 TECHNOLOGY

2.6.2 Grade 6

2.6.3 STRUCTURES

2.6.4 Module 9

2.6.5 DESIGN A BASIC FRAME STRUCTURE

Design a frame structure using a sheet of cardboard

What is the problem?

Due to the fact that every learner has to compile a portfolio of his/her best work in a grade during the year, it can cause a great mess if your pages of the 10 different learning areas get mixed up when you want to replace pages. Therefore it is important that you keep the three pages of each learning area together by using a paper clip in your portfolio so that you will not waste unnecessary time when you want to replace pages.

What is the need?

You will need a small container in which you can keep your paper clips and have extra available when you need to replace pages. Since nothing suitable is available in the shops at present, you will have to design and construct your own container.

What is the instruction?

Design and make a small container for paper clips that you can keep on your desk. Use felt-tipped pens to decorate the lid with a simple geometric pattern and see to it that the lid fits tightly.

What are the limitations?

[6] This content is available online at <http://cnx.org/content/m22626/1.1/>.

You may only use one piece of A4 cardboard, a wooden strip of 0,5 m long, and 1 cm by 1 cm, paper glue and felt-tipped pens with which to decorate it.

Summary of the need/design brief

2.6.6 ASSIGNMENT 1:

2.6.7 [LO 1.4]

Complete:

I am going to design and make a neat and attractive container that can hold______________

It can be made of ____________________________________ and ________________________

for use in the ______________________________________ The lid will be decorated with a

_________________________________ pattern with ________________________________.

Research and investigation:

2.6.8 ASSIGNMENT 2:

2.6.9 Bring to class as many small containers as possible in which paper clips could be kept and draw at least three examples with labels. Take care that their shapes, sizes and the material used for each container differ as much as possible.

2.6.10 [LO 1.2]

Design:

2.6.11 ASSIGNMENT 3:

2.6.12 Design and draw the frame for the container on the provided grid paper.

2.6.13 [LO 1.5]

Design and draw the frame for the container on the provided grid paper. You are going to use the small wooden bar. The inner dimensions of the small container must not be more than 10 cm by 10 cm and not smaller than 5 cm by 5 cm because it must be able to contain at least 10 paper clips quite easily. Colour the small strips that are of the same length, in one colour. Also indicate the inner and outer dimensions of your design. Draw a circle around your final choice.

- **Remember:** Assume that one square is 1 cm by 1 cm, so it is not necessary to use a ruler. Keep in mind that the longer sides of the frame include the shorter sides.

Table 2.3

2.6.14 ASSIGNMENT 4:

2.6.15 Design and draw simple geometric shapes with which you would like to decorate the lid. You may choose and use one basic shape only. Draw it the same size, as you would have it on the lid.

2.6.16 [LO 1.6]

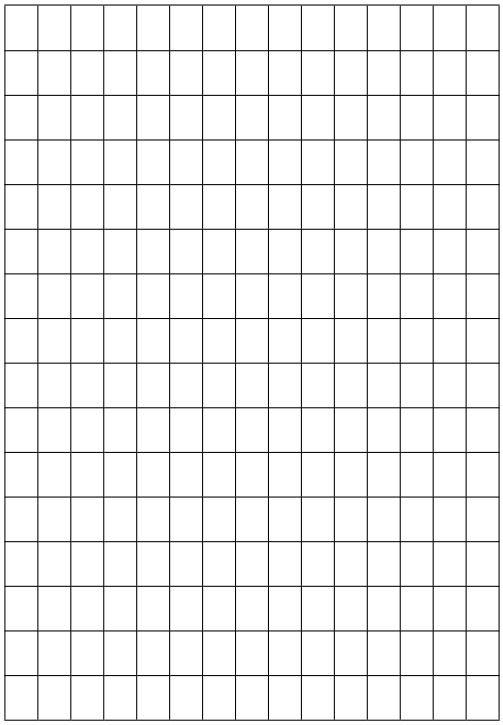


Table 2.4

2.6.17 Assessment

Learning Outcomes(LOs)

LO 1

TECHNOLOGICAL PROCESSES AND SKILLS

The learner will be able to apply technological processes and skills ethically and responsibly using appropriate information and communication technologies

Assessment Standards(ASs)

We know this when the learner:

1.2 finds out about existing products relevant to a problem, need or opportunity, and identifies and compares their design aspects (e.g. who it is for, what it is for, what it looks like, what it is made of, how well it works, whether it will affect the environment);

1.4 writes or communicates a design brief for the development of a product related to a given problem, need or opportunity that clarifies the technological purposes of the solution;

1.5 suggests and records at least two alternative solutions to the problem, need or opportunity that link clearly to the design brief and to given specifications and constraints (e.g. people, purpose, safety, environmental impact, appearance);

1.6 chooses one of these solutions, giving valid reasons for the choice, and further develops the choice with graphics and/or modelling.

2.7 Costruct a basic frame structure[7]

2.7.1 TECHNOLOGY

2.7.2 Grade 6

2.7.3 STRUCTURES

2.7.4 Module 10

2.7.5 CONSTRUCT A BASIC FRAME STRUCTURE

Manufacturing

You are now going to make the container. Follow the instructions carefully and when you have completed one specific step, mark your progress in the frame.

aSSIGNMENT 1:

a) Measure and mark the four required lengths with a ruler and pencil on the wooden strip (as decided in assignment 1 of the design).

[7] This content is available online at <http://cnx.org/content/m22628/1.1/>.

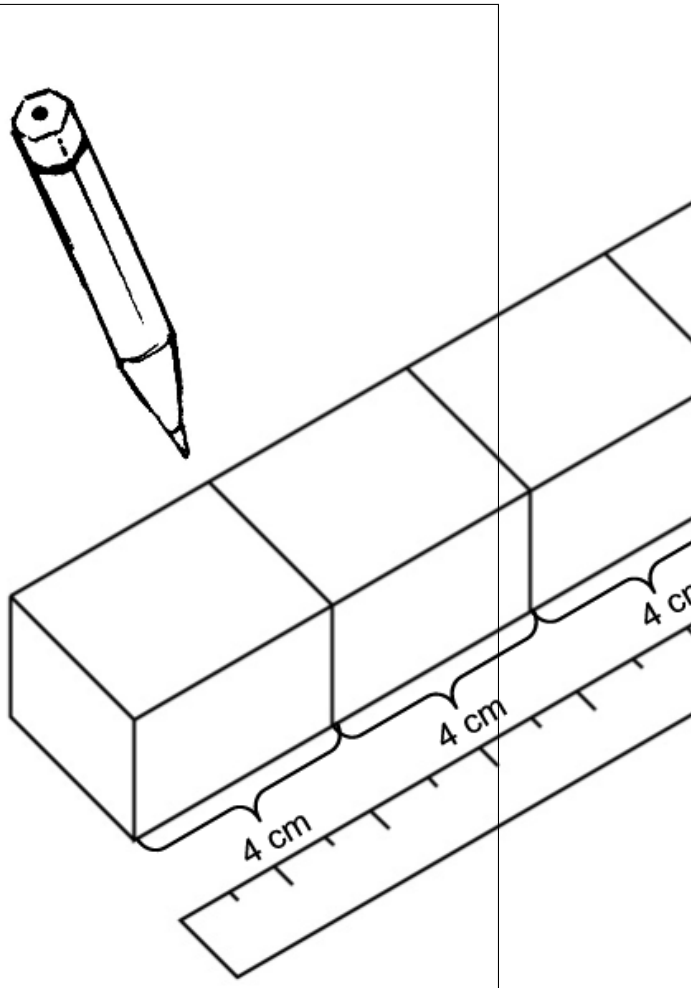
e.g.	

Table 2.5

b) Use a fretsaw, a carpenter's square and a sawhorse, and cut the four required lengths.

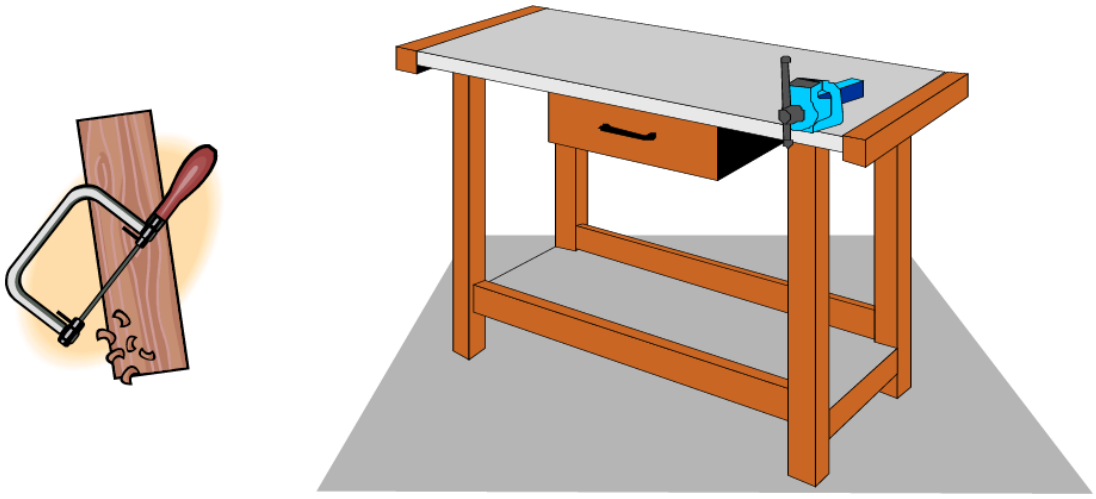


Figure 2.56

c) Using a pair of scissors, cut a strip of cardboard as wide as a ruler (3 cm) from the A4 piece of cardboard.

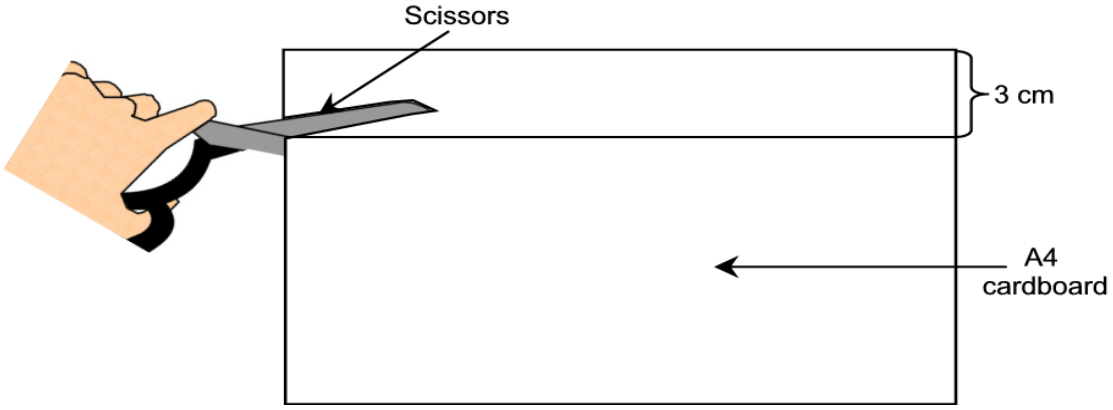


Figure 2.57

d) Draw squares of 3 cm wide on the cardboard and cut them off.

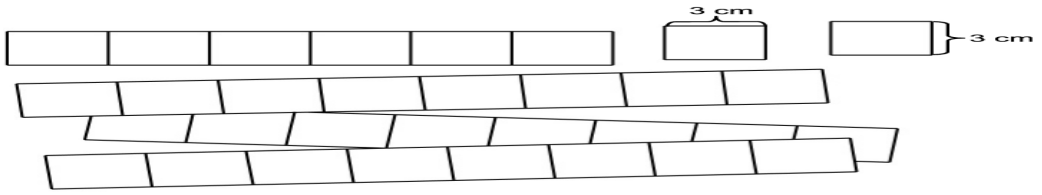


Figure 2.58

e) Cut through the middle of each square to make triangles.

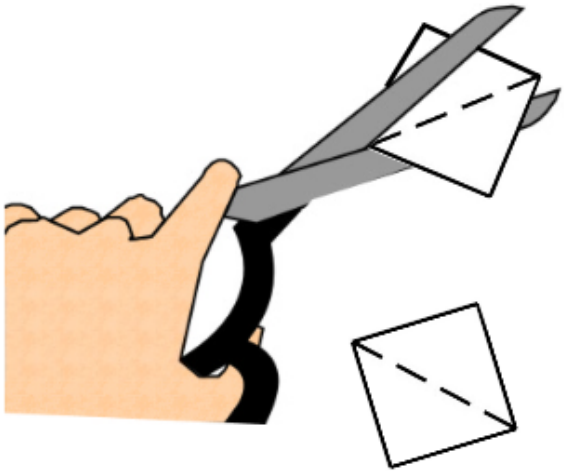


Figure 2.59

f) Place two wooden strips against each other to make a 90° angle on a sheet of paper on which a 90° angle has already been drawn.

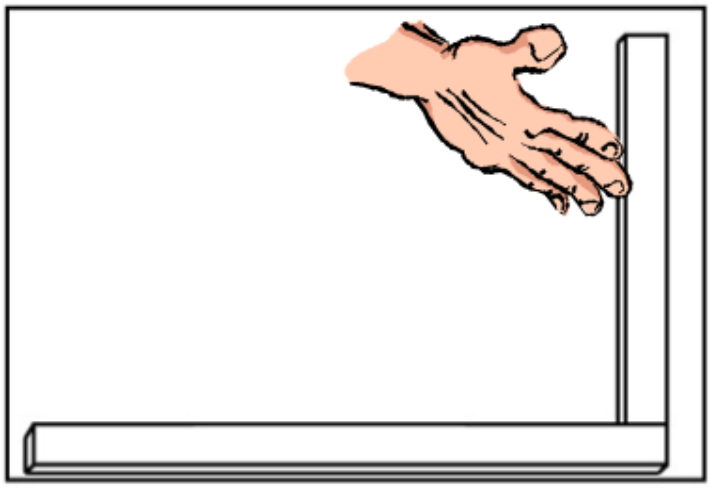


Figure 2.60

g) Paste a cardboard triangle across the 90° angle that is formed by the two wooden strips. Use paper glue to stick it.

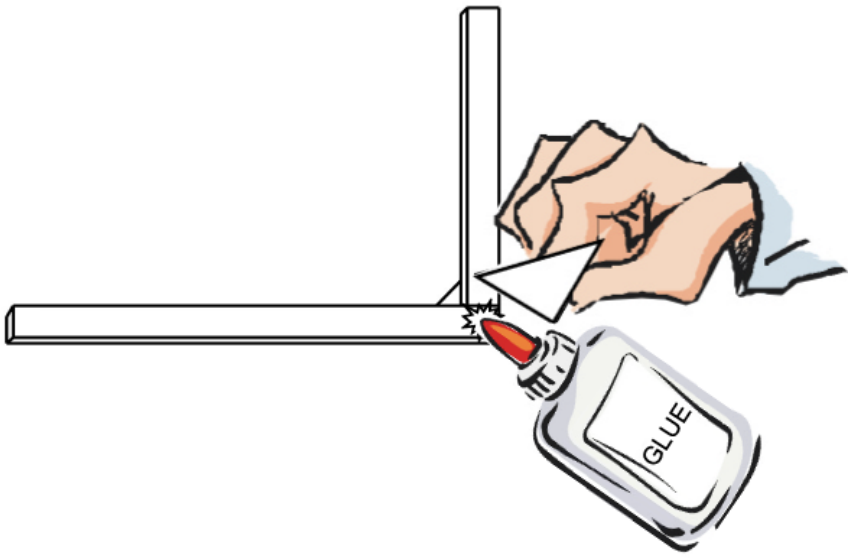


Figure 2.61

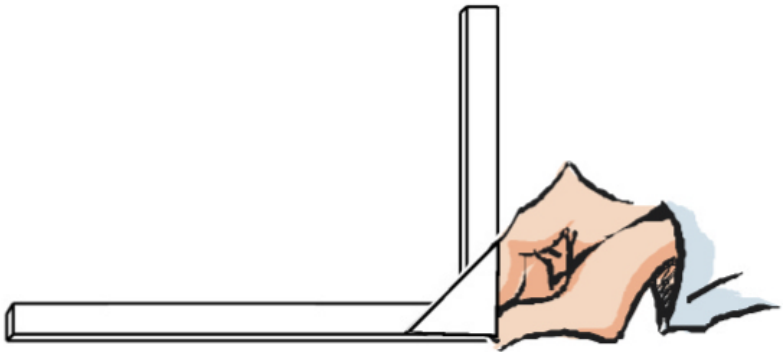


Figure 2.62

h) Complete the other three angles as you did in numbers *f* and *g*.

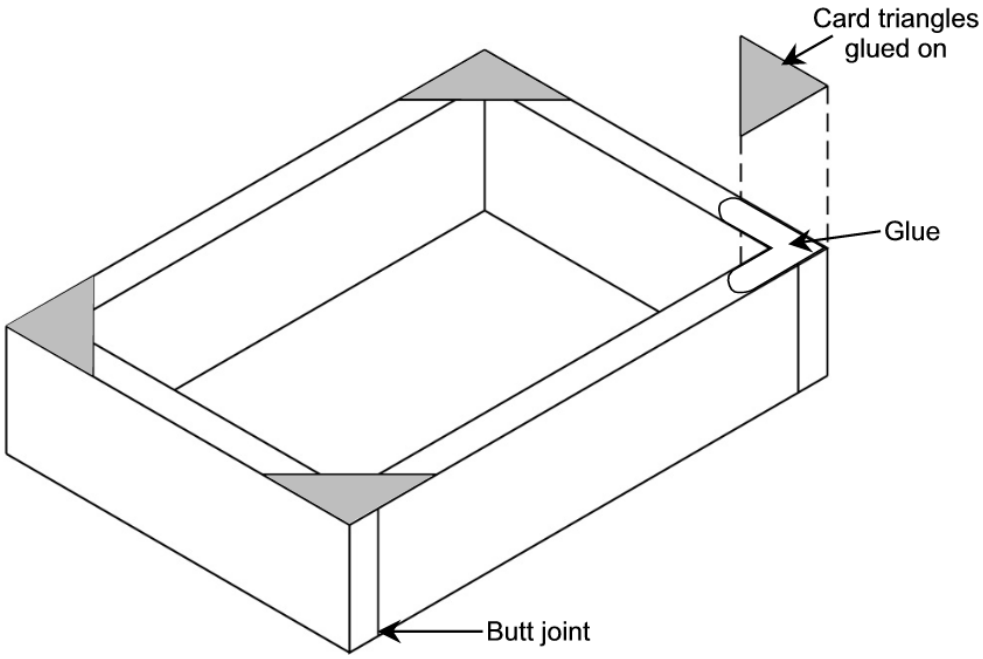


Figure 2.63

I) Turn the frame over and paste four triangles onto the opposite side. Use paper glue.

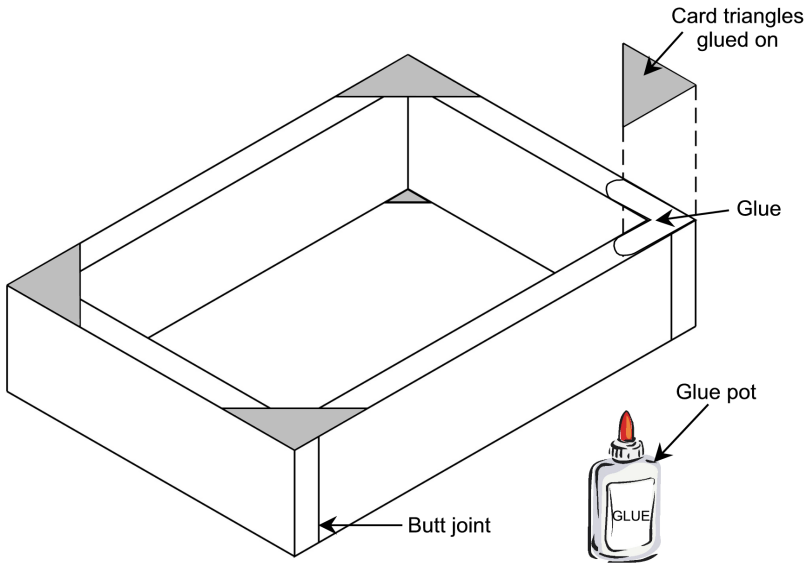


Figure 2.64

j) Copy the frame on cardboard. Place it against the edge. Mark one angle on the frame and cardboard with a star so that the container keeps its shape (stars next to one another).

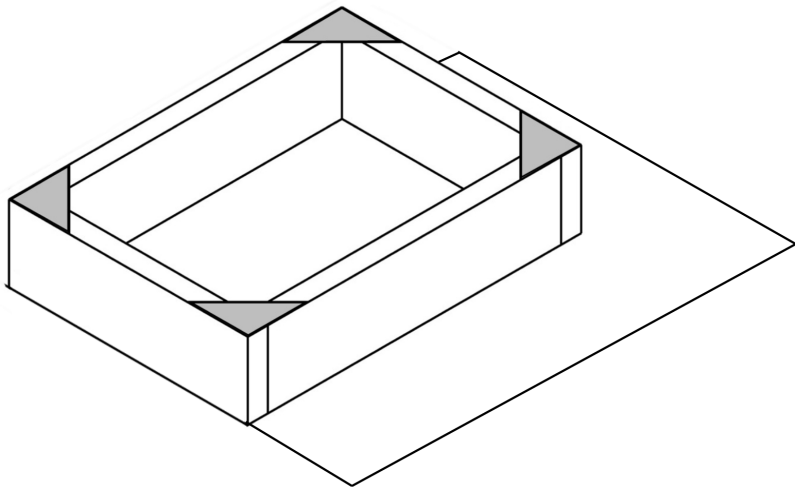


Figure 2.65

k) Cut out the bottom of your container from cardboard and paste the frame to it.

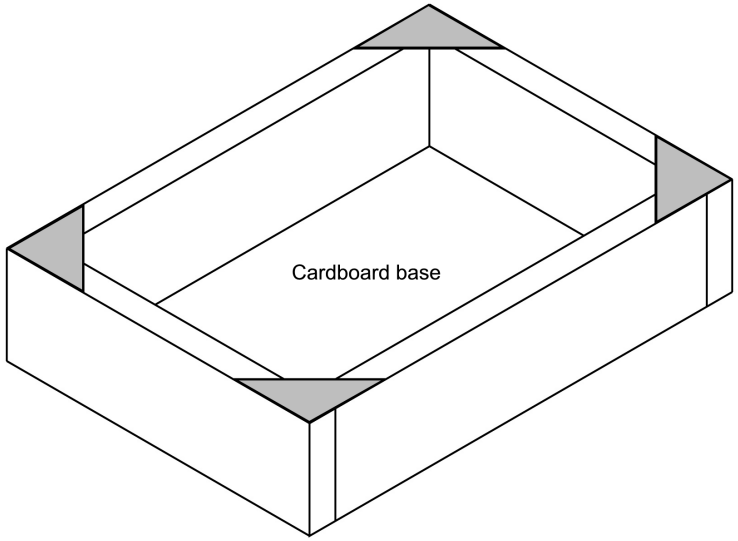


Figure 2.66

l) Draw the other side of the frame on cardboard. This is the lid.

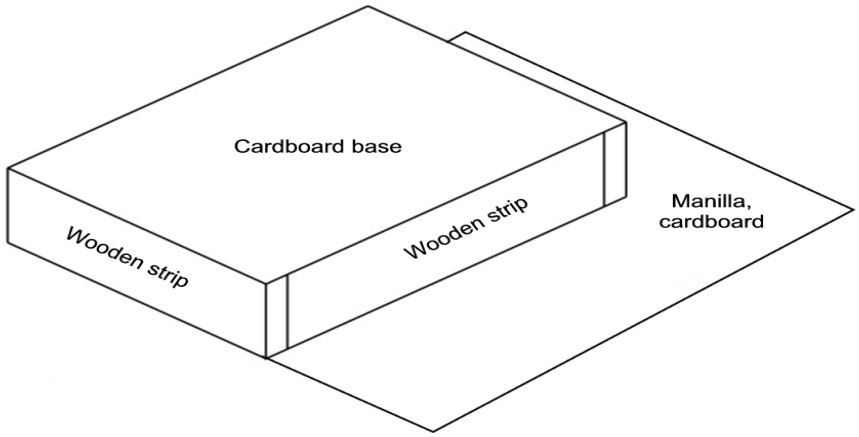


Figure 2.67

m) Cut it out.

n) Decorate the top of the lid by transferring a design from your page by using a pencil and carbon paper. Complete it with the felt-tipped pens.

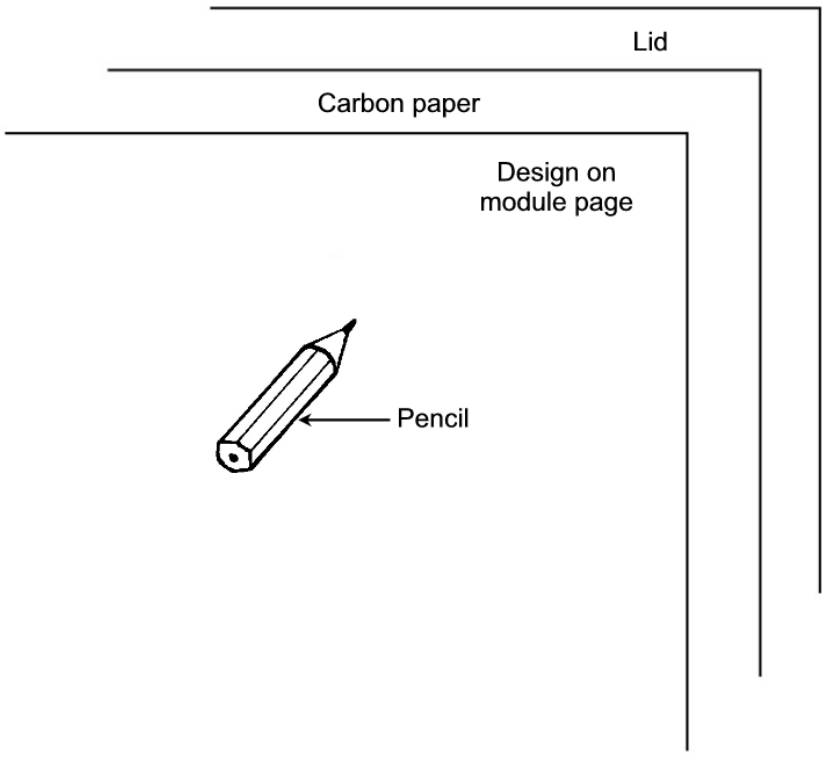


Figure 2.68

o) Cut a strip of cardboard of 2 cm wide so that it is just as long as the longest side of the container.

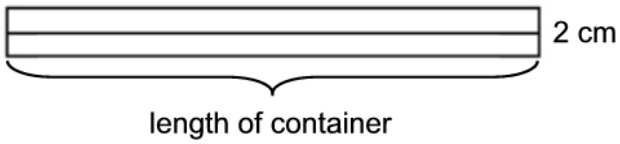


Figure 2.69

p) Notch it exactly in the middle, using a pair of scissors and a ruler. Do this on a suitable surface. Fold it to work as a hinge.

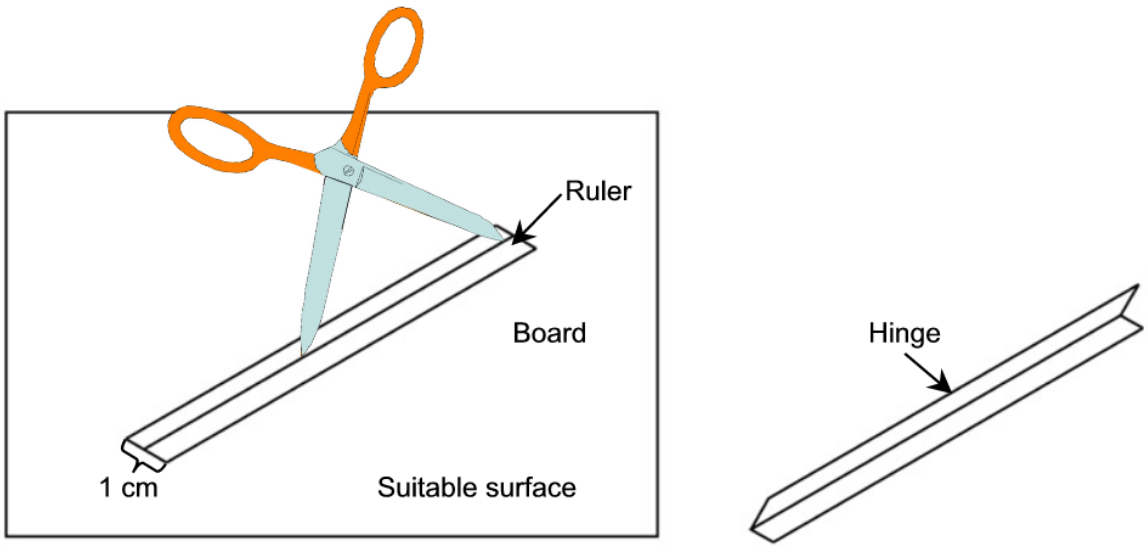


Figure 2.70

q) Glue the hinge to the framework and lid so that it opens with the lid. Approximately 1 cm must extend at the back. The less attractive side of the hinge must be pasted onto the frame and lid so that the clean side is visible when the lid is opened.

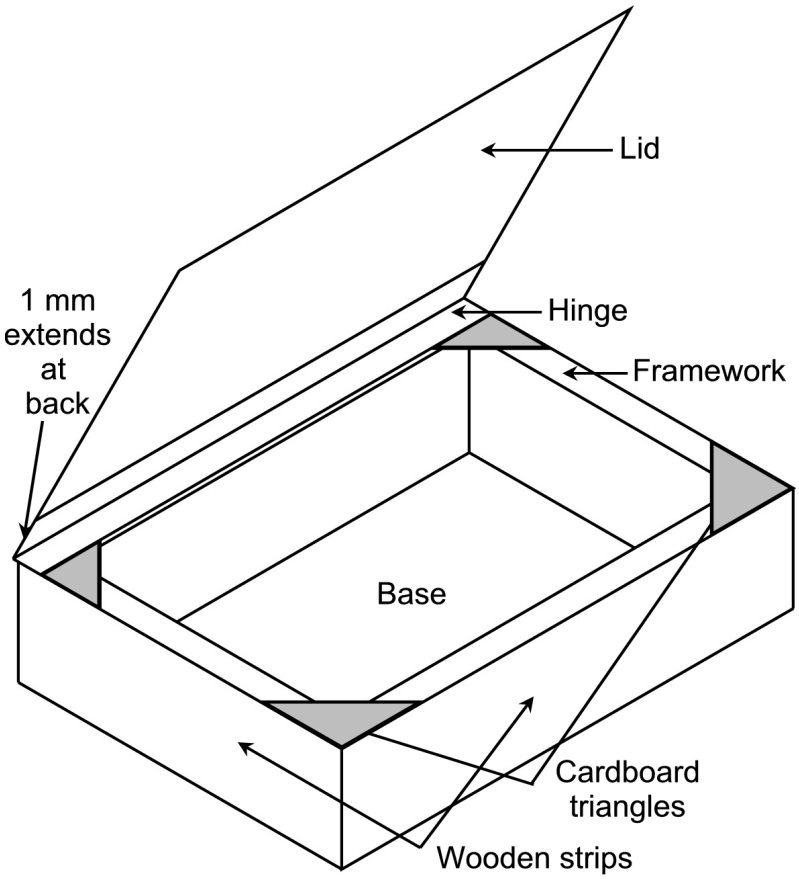

Lid
1 mm
extends
at
back
Hinge
Framework
Base
Cardboard
triangles
Wooden strips

Figure 2.71

2.8 Othographic drawings[8]

2.8.1 TECHNOLOGY

2.8.2 Grade 6

2.8.3 STRUCTURES

2.8.4 Module 11

2.8.5 ORTHOGRAPHIC DRAWINGS

2.8.6 ASSIGNMENT 1:

2.8.7 You must now draw an orthographic view of your completed container.

2.8.8 [LO 1.2]

What is an orthographic drawing?

It is a method of drawing a 3D object correctly as seen from different views. Each view is drawn as if it is a flat surface and in 2D. Usually a shape is drawn from three views, namely the front view, the side view and the overhead top view or plan.

a) Below there are some 3D figures. Next to each one of them there are three shapes. This shows what the objects will look like from the front, the side and from above. Write underneath each 2D figure whether it is the image as seen from the front, from the side or from above.

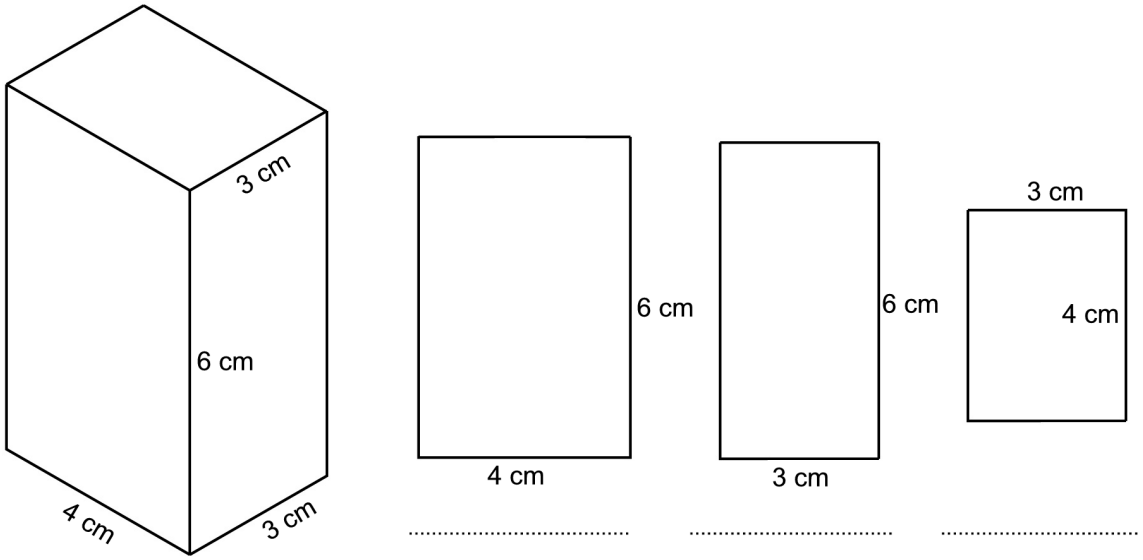


Figure 2.72

[8]This content is available online at <http://cnx.org/content/m22632/1.1/>.

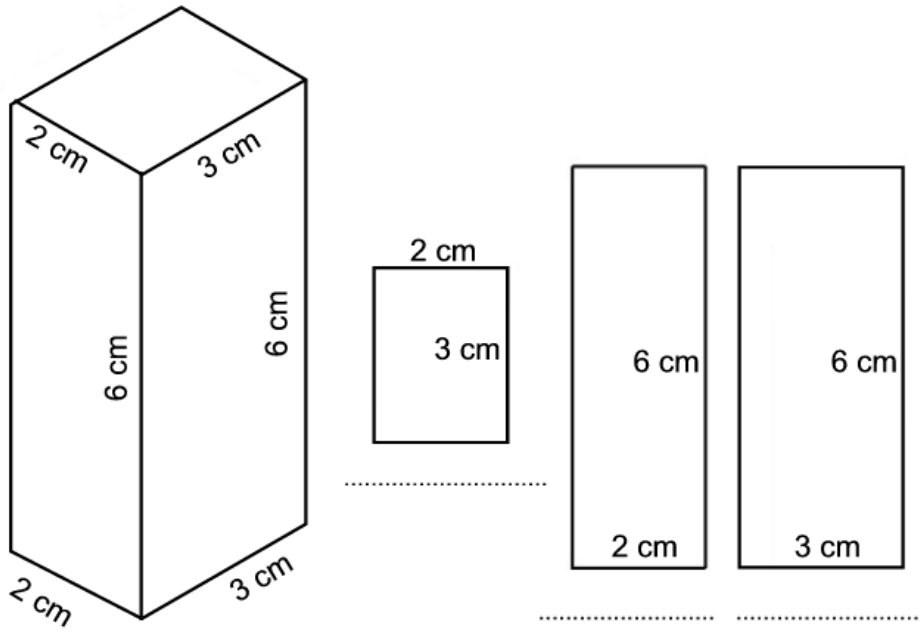


Figure 2.73

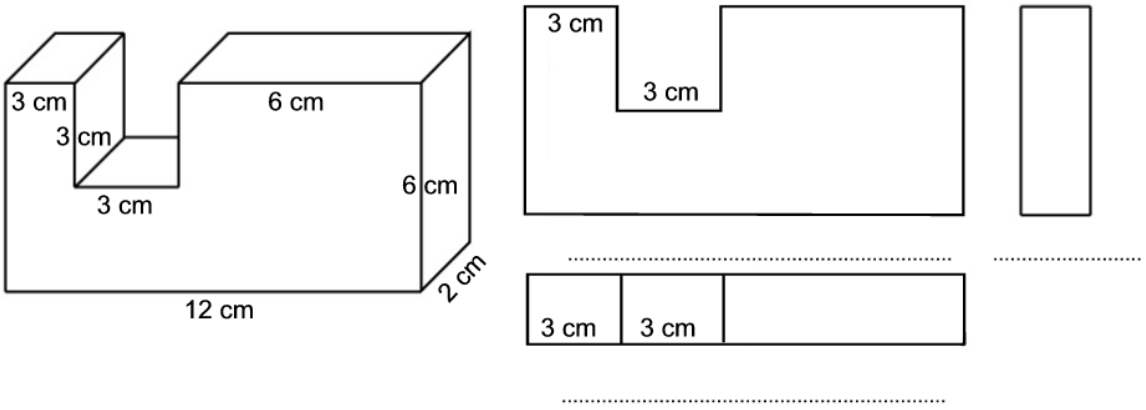


Figure 2.74

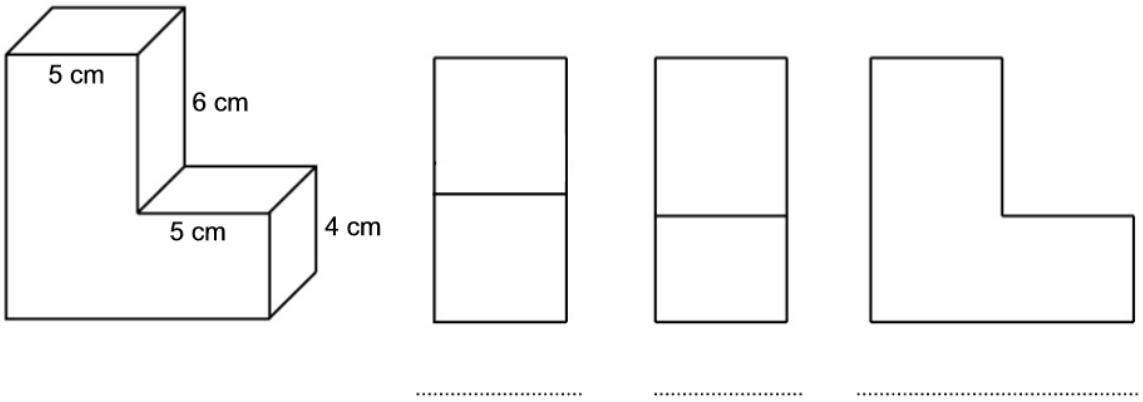


Figure 2.75

b) Let's first practise how to make an orthographic drawing.
Remember:

- Do it on grid paper.
- See to it that the length, width and height of the shape are indicated. (Sketch 1).

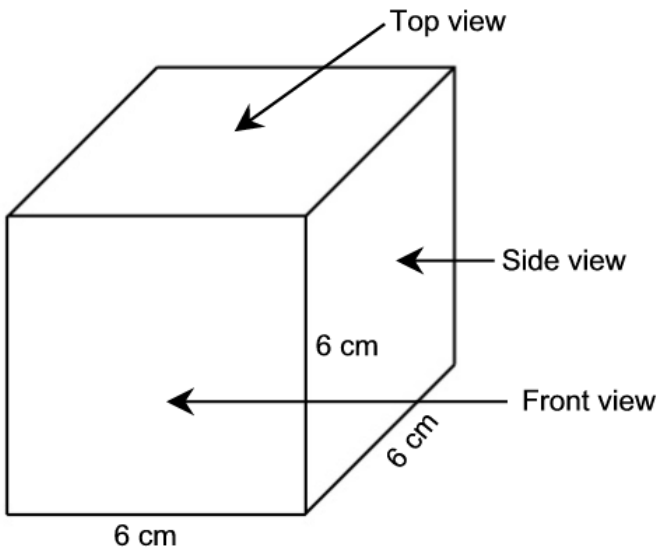


Figure 2.76

- Start with the front view, which is always drawn, in the left-hand top corner.

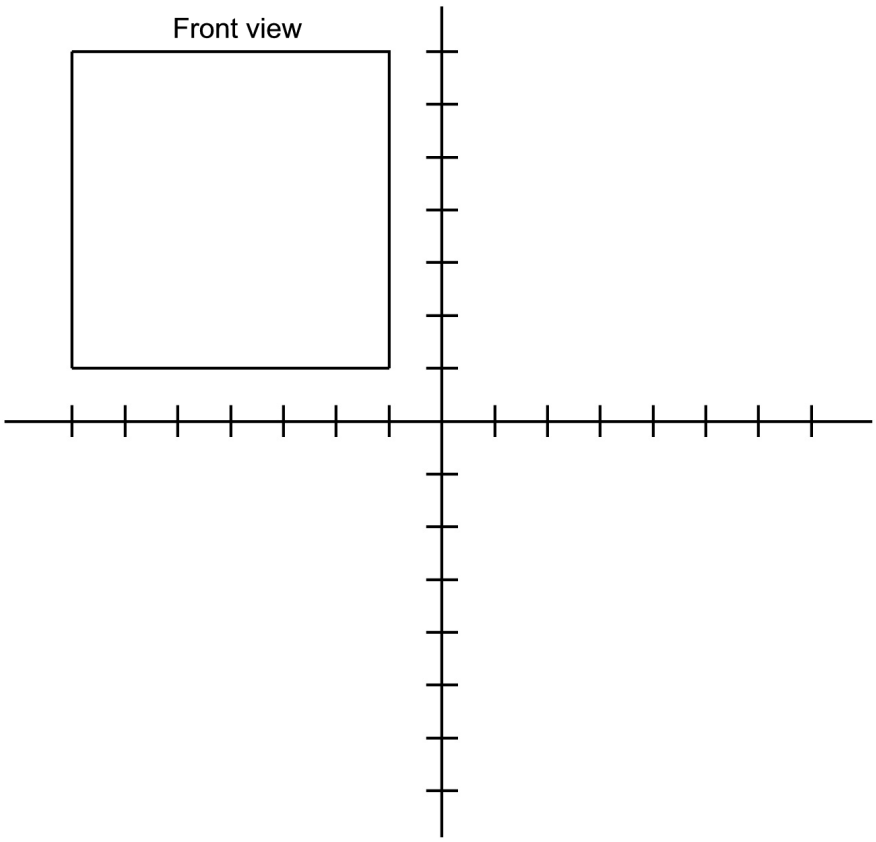


Figure 2.77

- The top view is drawn next in the left-hand bottom corner. (Extend the vertical sides of the front view.)

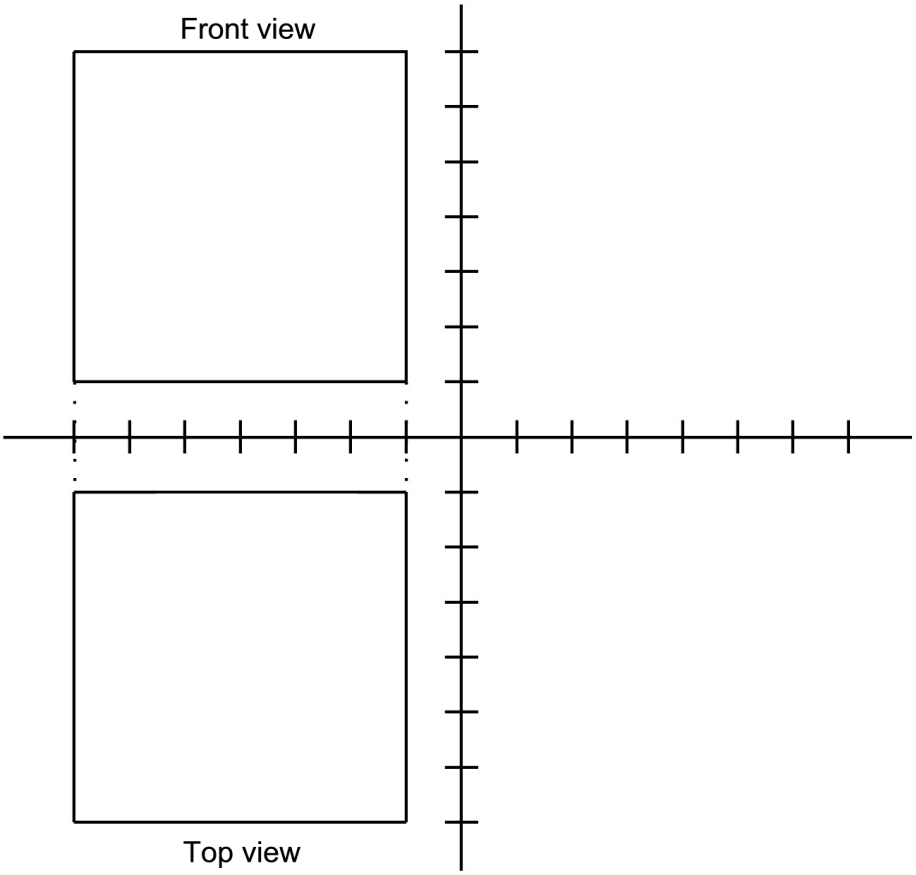


Figure 2.78

- The side view (from the right) is always drawn in the right-hand top corner. (Extend the horizontal sides of the front view.)

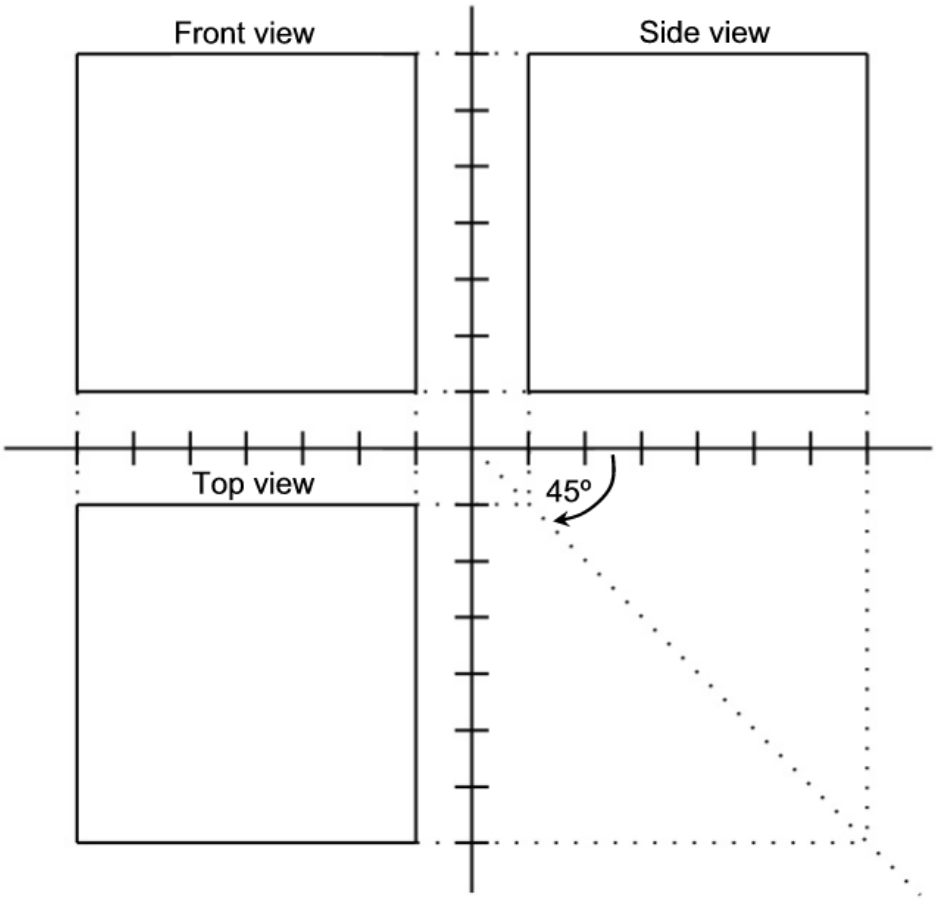


Figure 2.79

- Each space on the axes represents one cm. Start with the first mark.
- Halve the remaining space diagonally across the front with a 45 ° diagonal line. Use this line to transfer the lengths from the top view to the side view.
- Complete all three views and provide the necessary captions.

- Now also make 2D drawings of the following 3D shapes. First indicate the views relevant to each shape.

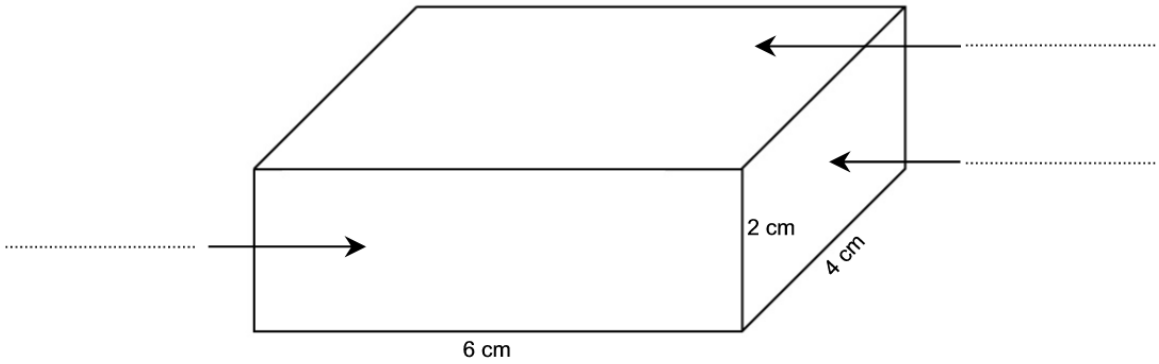


Figure 2.80

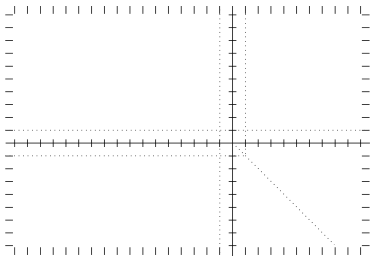


Figure 2.81

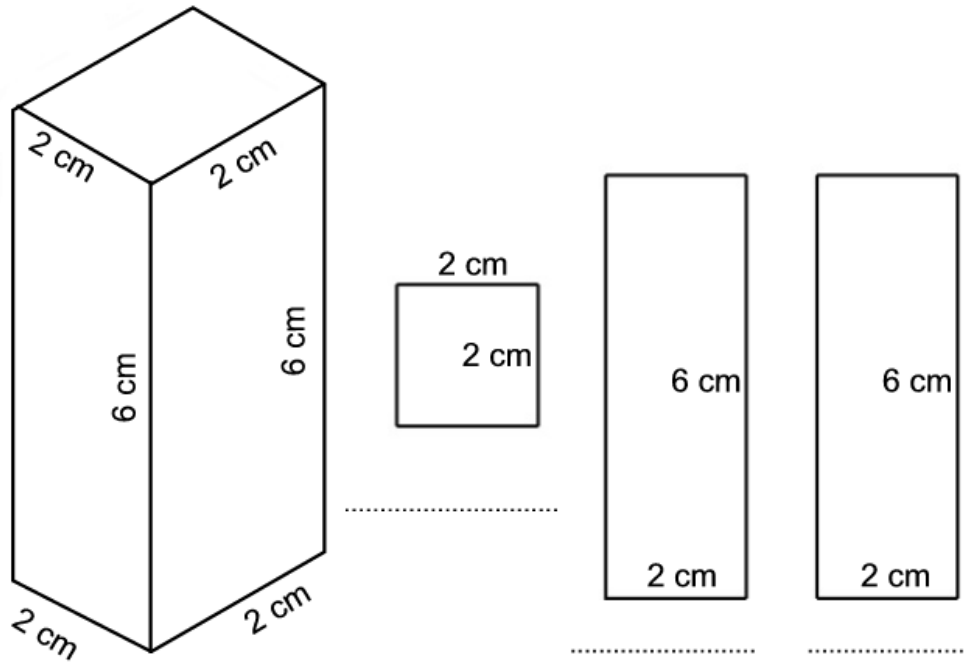


Figure 2.82

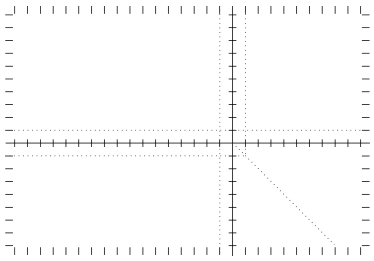


Figure 2.83

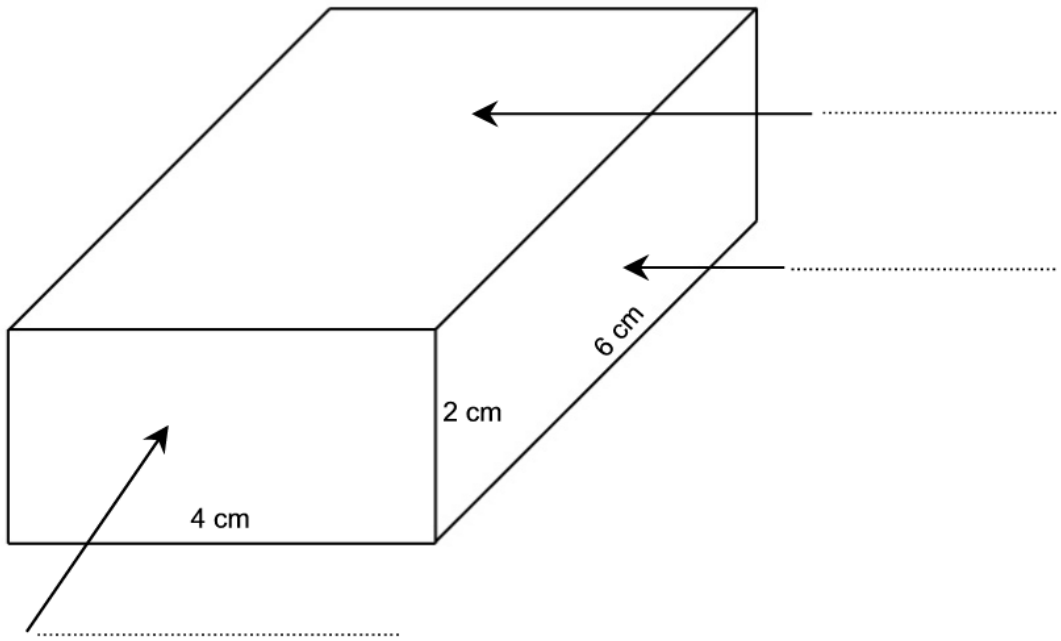


Figure 2.84

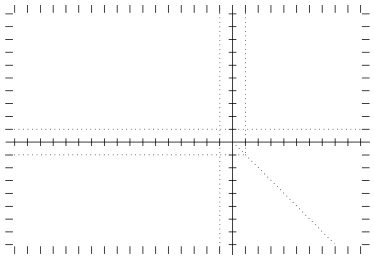


Figure 2.85

2.8.9 Assessment

Learning Outcomes(LOs)

LO 1

TECHNOLOGICAL PROCESSES AND SKILLS

The learner will be able to apply technological processes and skills ethically and responsibly using appropriate information and communication technologies

Assessment Standards(ASs)

We know this when the learner:

1.2 finds out about existing products relevant to a problem, need or opportunity, and identifies and compares their design aspects (e.g. who it is for, what it is for, what it looks like, what it is made of, how well it works, whether it will affect the environment).

Chapter 3

Term 3

3.1 Discovering energy[1]

TECHNOLOGY

3.1.1 Grade 6

3.1.2 SYSTEMS AND CONTROL: AN ELECTRICAL SHOCK

3.1.3 Module 12

3.1.4 DISCOVERING ENERGY

3.1.5 Background information

Guess this! What is the word for the ability to do work? What can neither be created of destroyed? What can only be transferred from one form to another? You are correct:

E_ _

The main source of energy in nature is the sun, because it radiates heat and light energy. Plants use this light and heat energy and change it into chemical energy, which they use for growing.

People and animals also use energy for everything that they do. We obtain energy by eating food. The chemical energy that is trapped in food is converted into kinetic energy (motion) inside our bodies. This makes it possible for the muscles of our bodies to do their work.

All the foods that we eat therefore contain energy, to a lesser or greater degree. Can you name the unit that is used to measure the amount of energy that is contained in food?

3.1.6 Assignment 1

3.1.7 [LO 2.4]

Study the labels on tins and boxes containing food. Complete the following table to determine the energy value of different kinds of food:

[1] This content is available online at <http://cnx.org/content/m22636/1.1/>.

FOOD	QUANTITY, e.g. 100g	KILOJOULES per 100g

Table 3.1

3.1.8 Assignment 2

3.1.9 [LO 2.4]

Which food types contain the highest amount of kilojoules per 10 g/ml?

3.1.10 Deduction

Foods like fats, oils, proteins, sugar and starches are able to supply the body with energy. Sugar and starch (carbohydrates) supply more energy and do this faster than other foods. If you do not get enough exercise and therefore do not manage to get rid of this energy, excess energy is stored in your body as **fat**.

3.1.11 Assignment 3

3.1.12 [LO 2.4]

Why would an athlete who takes part in a race like the Comrades Marathon, eat pasta before the race?

Food supplies energy for us to be able to do work. Machines also need energy to be able to work. There are many different kinds of energy, namely:

Chemical energy	An object has the ability to exhibit energy because of its chemical composition.
Potential energy	Any object that is not on the earth's surface has the ability to return (fall back) to the earth because of the earth's force of attraction.
Kinetic energy (motion)	The energy of a moving object.
Heat energy	An object's ability to radiate warmth.
Light energy	An object's ability to radiate light.
Electrical energy	An object's ability to conduct electricity.

continued on next page

Sound energy	An object's ability to produce sound.

Table 3.2

Transfer of energy occurs continuously in objects. We speak of this as the conversion of energy.
Assignment 4

3.1.13 [LO 2.4]

Energy conversion takes place in the following appliances and objects: a stove, a high fidelity system, a light bulb, a ball attached to a length of elastic, an electric train, a car battery. Match these examples to the different kinds of energy conversion listed below.

(a) conversion of electric energy to sound energy:
(b) conversion of electric energy to heat energy:
(c) conversion of potential energy to kinetic energy:
(d) conversion of electric energy to light energy:
(e) conversion of electric energy to kinetic energy:
(f) conversion of chemical energy to electric energy:

We are going to use this module to examine electric energy. **Electricity** is very useful, because it is a type of energy that can easily be converted to other forms of energy. It does not pollute or damage the environment and can be stored easily and safely.

There are two main types of electricity: **mainstream electricity** and **batteryelectricity**.

3.1.14 Assignment 5A

3.1.15 [LO 2.4]

Create a poster showing electrical implements that work with mainstream electricity a
and with battery electricity.

3.1.16 Background information:

3.1.17

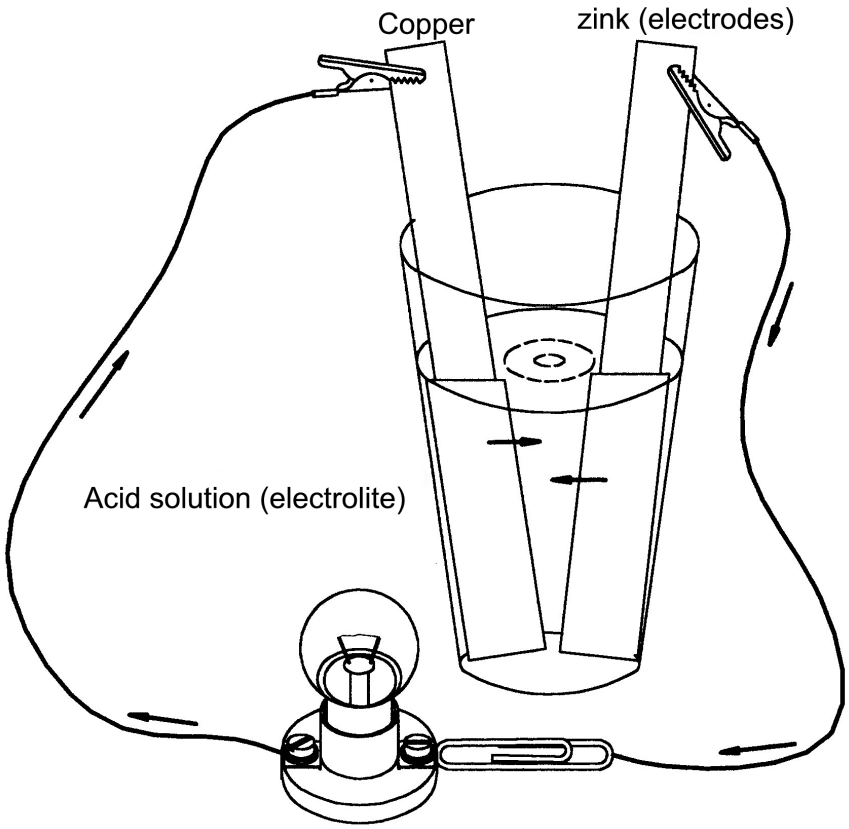


Figure 3.1

Chemical energy is electrical energy that is trapped in the chemicals inside a battery, which therefore has the potential to generate an electrical current. In a wet cell battery, two metal strips that are referred to as electrodes and are of copper and zinc are placed in an acid solution named an electrolyte. A chemical reaction occurs and this creates electrical power. Negative electrons flow through the acid solution from the copper to the zinc. The current returns to the copper via the wire and this is how the electricity flows. The chemical energy stored inside the battery is measured in VOLT. We have batteries with varying strengths, each with a negative and a positive pole.

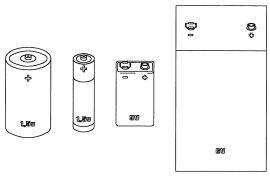


Figure 3.2

The first battery was made in 1790, by the Italian Allessandro Volta.

Current always flows from a positive pole to a negative pole in an electrical circuit. The electrical current therefore is created when electrons move in one direction along a length of wire. To provide electrical energy, the electrons need to move in an uninterrupted circuit, the **electrical circuit**. The only way in which it is possible to see whether there is a flow of electricity, is to observe its effect.

What are the basic elements of an electrical circuit?

- There has to be a source of energy, e.g. a battery, or electricity, or a generator;
- There has to be a conductor through which the electrical current can flow. This usually is some sort of metal which offers little resistance to the electrical circuit.
- There has to be a switch by means of which the electrical current can be made to flow or be interrupted.
- There has to be a load to use the electrical current, i.e. a source of light, sound, motion or heat, so that the chemical energy can be converted into electrical energy, which can become one of the above four energies.

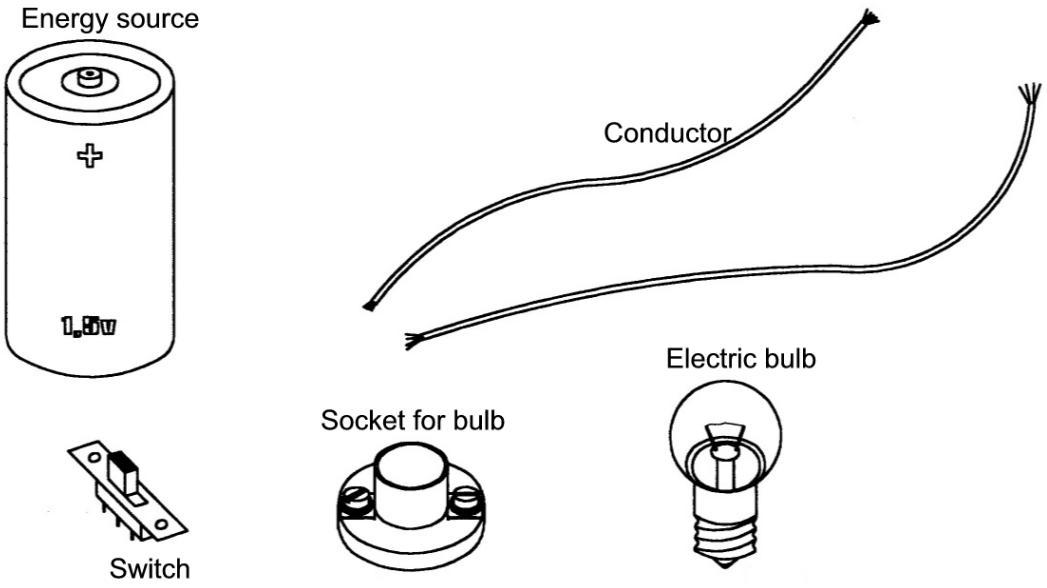


Figure 3.3

Assignment 5B

3.1.18 [LO 2.4]

- Supply the necessary labels for the sketch of the 4 basic elements of the electrical circuit.

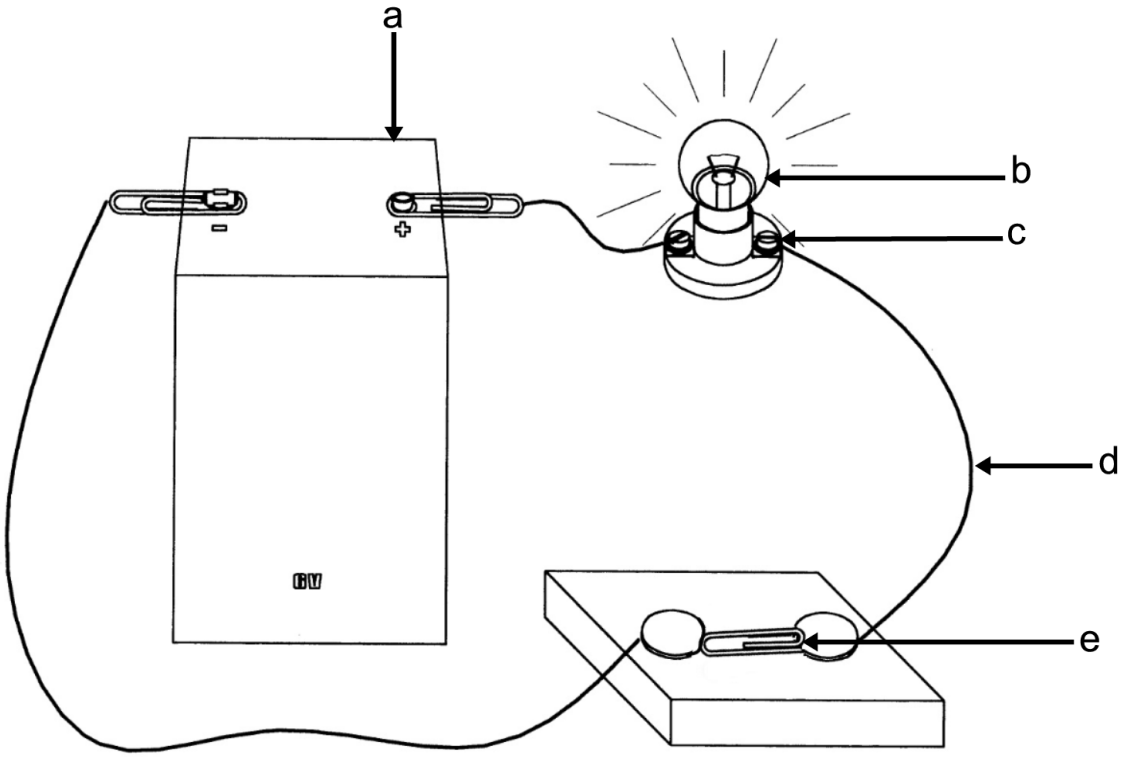


Figure 3.4

Isolators are materials that do not conduct electricity, e.g. plastic, rubber and glass. It is used to cover metal wires or light bulb sockets to prevent the current from flowing through other metal objects that may come into contact with it.

3.1.19 Assignment 5C

3.1.20 [LO 1.13]

A specific symbol is used for each element of the electrical circuit and this is useful when a **circuit** is represented in a **circuit diagram**.

	ELEMENT	SYMBOL	
	A battery		
	A conductor		
	A sliding switch		
	A light bulb		
	A LED		
	Direction of the current		

Table 3.3

3.1.21 Assignment 6

3.1.22 [LO 1.9]

Examine the following rules for how to take care when you use mainstream electricity to determine whether the statements are **TRUE** or **FALSE**. First do it individually and then discuss it with the rest of the group members.

	INDIVIDUAL	GROUP
1. Always dry your hands before handling electrical switches or implements.		
1. It is all right to pull out a plug when the wall switch is live.		
3. Do not pull a plug out of a wall socket by the electric cord, especially while the switch is on.		
1. A worn or frayed cord is not dangerous and cannot cause a fire.		

continued on next page

1. It is quite in order to fit a number of adapters to one socket if you want to use several electrical appliances simultaneously.		
1. Wall sockets are also fitted in bathrooms.		
1. It is dangerous to insert a metal object into a wall socket.		

Table 3.4

Assessment
Learning Outcomes(LOs)
LO 1
TECHNOLOGICAL PROCESSES AND SKILLS
The learner will be able to apply technological processes and skills ethically and responsibly using appropriate information and communication technologies.
Assessment Standards(ASs)
We know this when the learner:
1.9 works efficiently and safely;
1.13 chooses and uses appropriate technologies to present, record or communicate technological and/or scientific processes followed (e.g. simple portfolio, posters, charts, models, scientific investigations).
LO 2
TECHNOLOGICAL KNOWLEDGE AND UNDERSTANDING
The learner will be able to understand and apply relevant technological knowledge ethically and responsibly.
We know this when the learner:
2.4 demonstrates knowledge and understanding of the components of simple electrical circuits (e.g. connecting wires, battery, switch, output device), and how electrical energy can be converted into other forms (e.g. light, heat, sound, movement).

3.2 play with battery energy[2]

TECHNOLOGY

[2]This content is available online at <http://cnx.org/content/m22637/1.1/>.

3.2.1 Grade 6

3.2.2 DISCOVERING ENERGY

3.2.3 Module 13

3.2.4 'PLAY' WITH BATTERY ENERGY

3.2.5 Assignment 1

3.2.6 [LO 1.3]

Making an electrical circuit using a wet cell battery.
Equipment:

- A lemon to serve as an electrolyte.
- Small strips of copper and zinc / or a brass drawing pin and a steel paper clip that can serve as electrodes.
- Two lengths of copper wire for conductors.
- A light bulb and bulb stand to provide the light.
- Two paper clips for connecting the metal plates and the conductors.

Method:

- Cut the lemon in half and use one half.
- Attach the strip of copper / brass drawing pin to one side of the lemon and the zinc strip / paper clip to the other side.
- Connect a paper clip to each of the wires and slide the paper clips on to the plates.
- Attach the other ends of the wires to the light bulb.

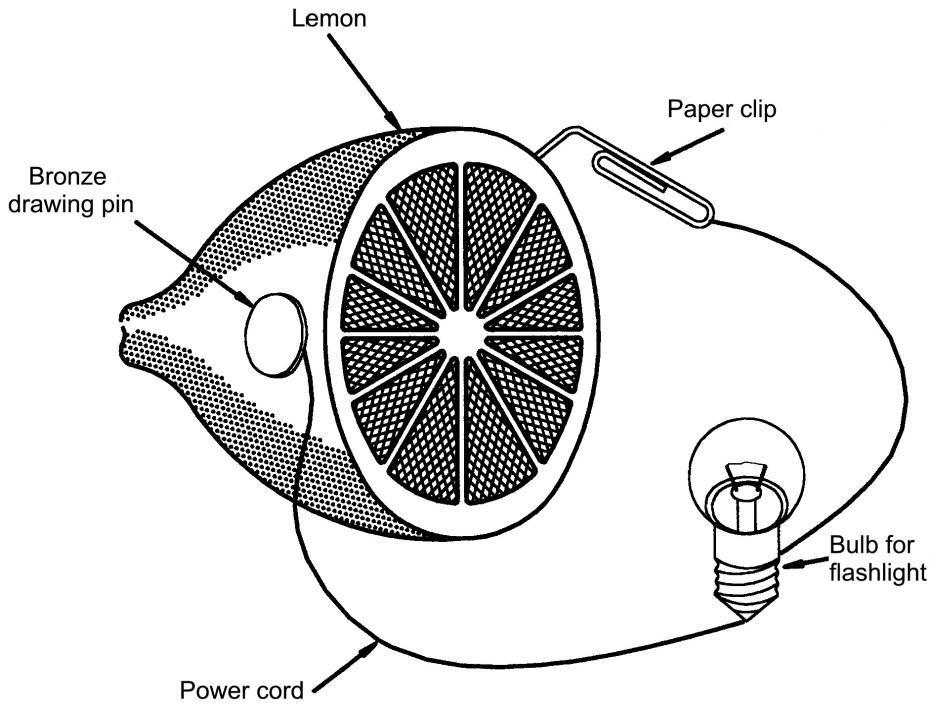


Figure 3.5

Observation:

Does the light bulb glow?

Connect an ordinary battery (a dry cell) and experiment with the circuit until the light bulb lights up with this battery.

Draw a circuit diagram of the electrical circuit to illustrate the flow of the current when the light bulb glows.

How could you increase the chemical energy to improve the brightness of the light from the light bulb?

3.2.7 Assignment 2A

3.2.8 [LO 1.3]

Experiment with each of the following suggestions and mark the suggestion that provides the best result:

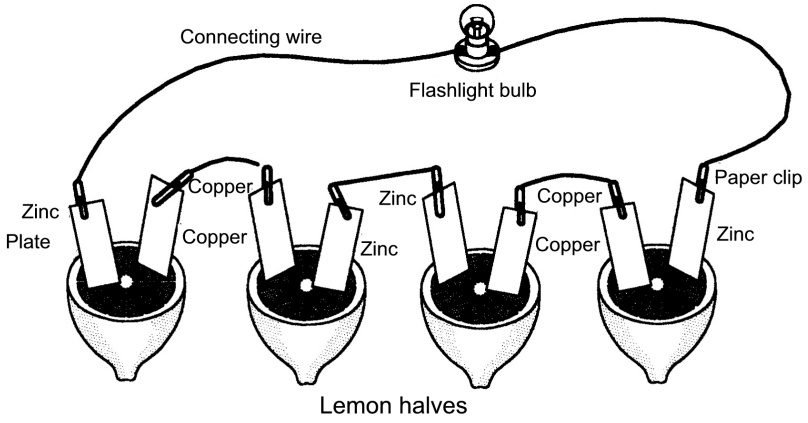


Figure 3.6

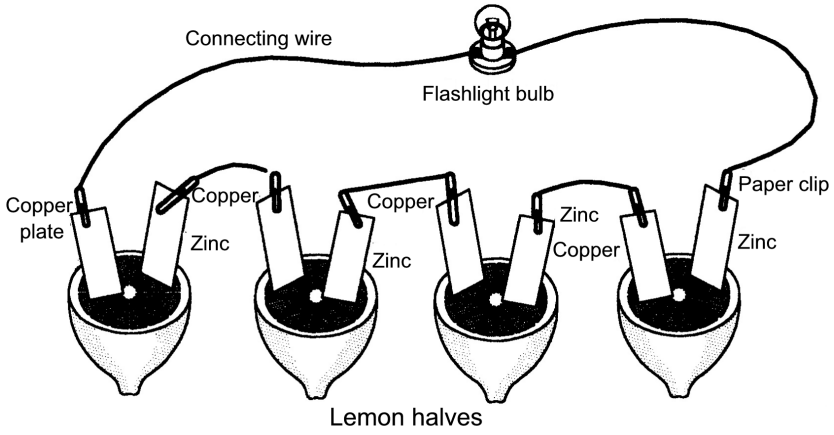


Figure 3.7

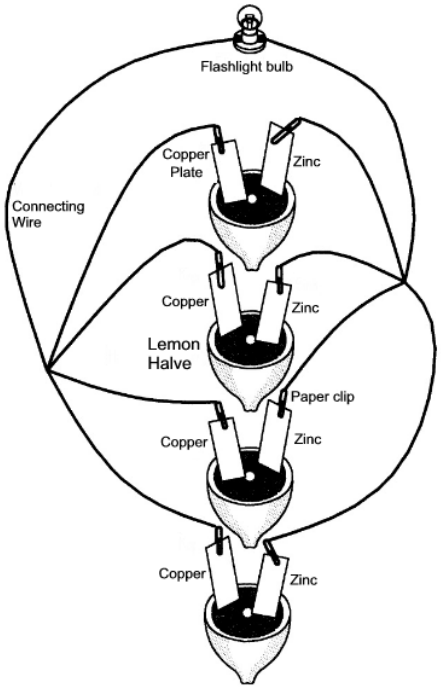

Flashlight bulb
Copper Plate
Zinc
Connecting Wire
Copper
Zinc
Lemon Halve
Paper clip
Copper
Zinc
Copper
Zinc

Figure 3.8

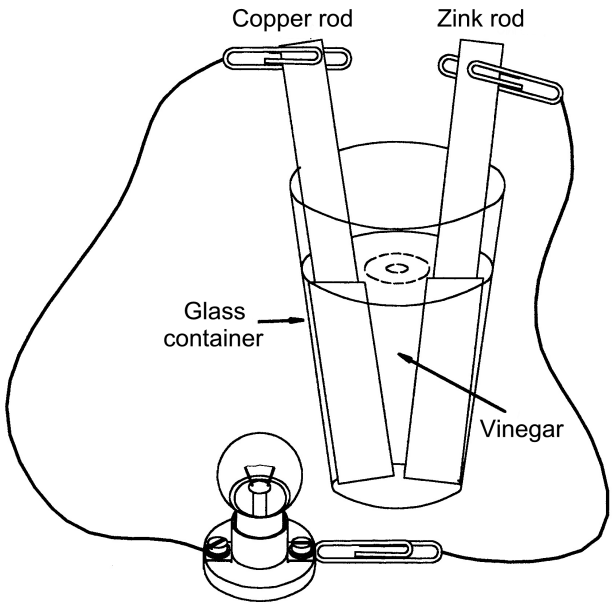


Figure 3.9

3.2.9 Background information

3.2.10 Cells can be connected in two different ways for making a battery.

- Cells are in series when a positive pole of one cell is linked to the negative pole of another cell. With increasing the number of cells connected in series, the current that is supplied becomes more powerful. This means that the light bulb will glow more brightly.

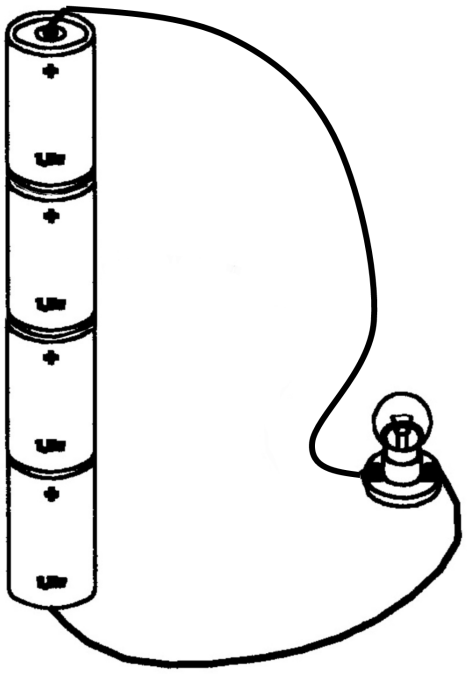


Figure 3.10

3.2.11

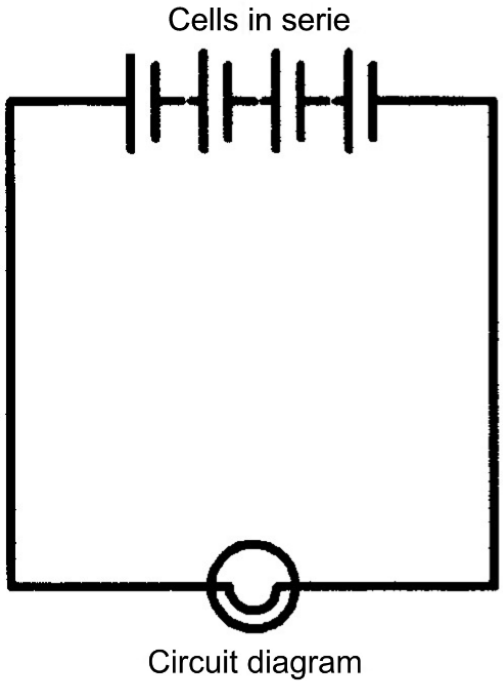


Figure 3.11

- Cells are linked in parallel when all the positive poles of the cells are connected with one another to create a positive connection with the battery.

3.2.12

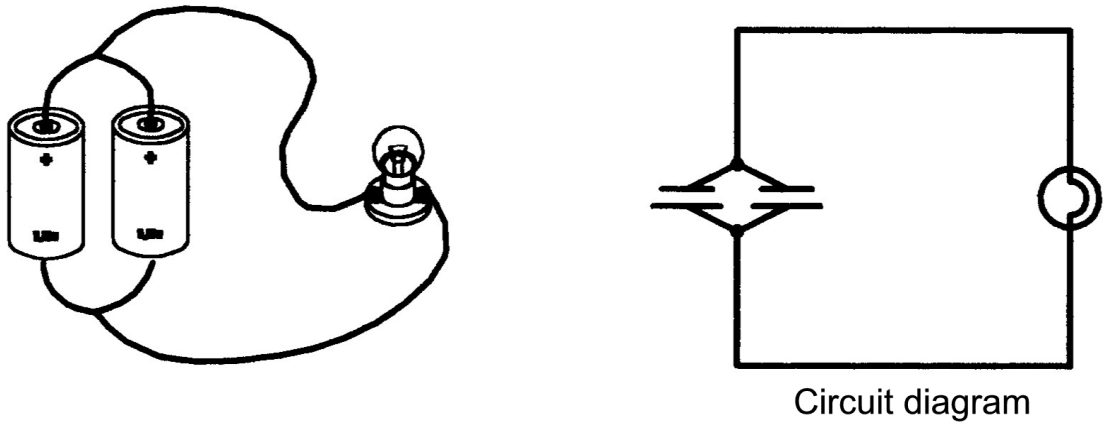


Figure 3.12

- The negative poles are also connected like this. When the number of cells that are connected in PARALLEL increases, the cells can produce the same current for longer.

3.2.13

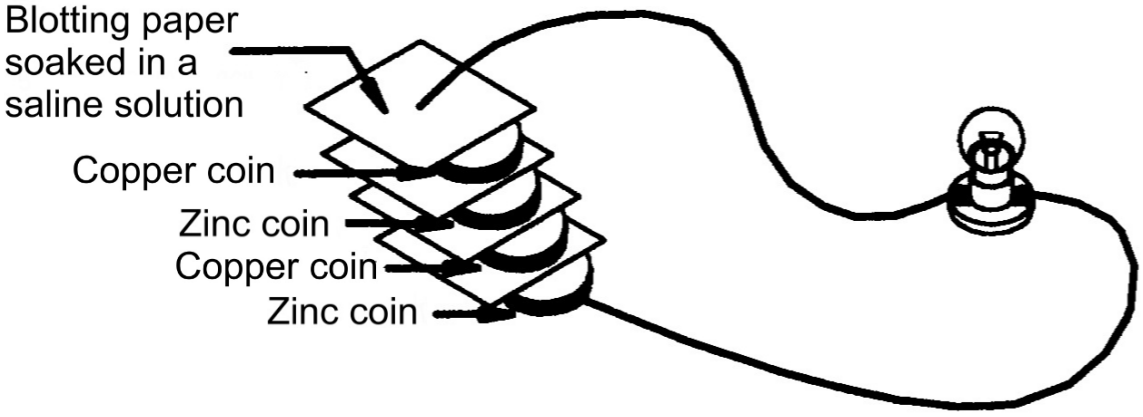


Figure 3.13

3.2.14 Assignment 2B

3.2.15 [LO 1.3, 1.6]

Create different switches for an electrical circuit. See how may different types of switches used in electrical appliances you can identify.

(a) What is a switch?

It is a device for opening or closing a circuit so that electricity can flow along the circuit or be prevented from flowing.

(a) Make each of the following switches and connect each to a battery and a light bulb to see if they work. Strip the isolation (plastic) from the ends of the wires before attaching them to the paper clips and use an elastic band to hold them in position against the paper clip.

If you want to use two or more batteries alongside one another, you could place them inside a cardboard or plastic tube.

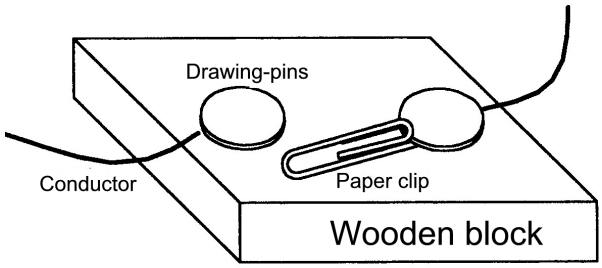


Figure 3.14

A sliding switch

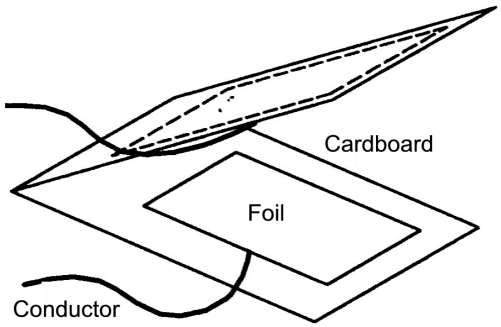


Figure 3.15

A push-button switch

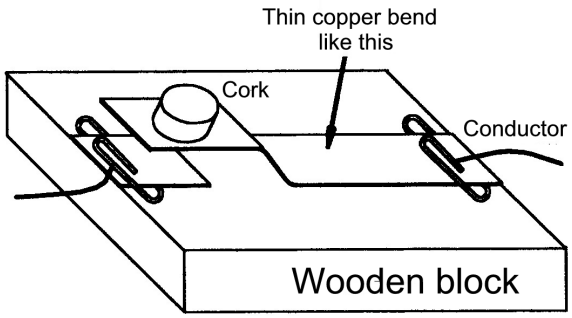


Figure 3.16

A click switch

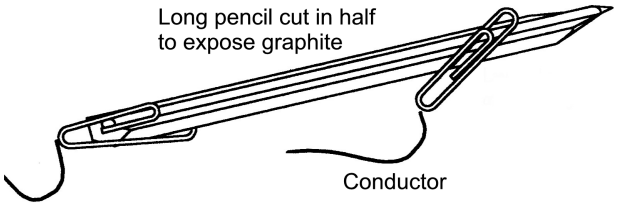


Figure 3.17

A dimmer switch

What happens when you slide one paper clip towards the other? Design your own switch. Add labels and colour to explain what the components are.

- Make a prototype of your switch and connect it to a circuit. Is your design successful?
- What type of switch did you make?

Assessment

Learning Outcomes(LOs)

LO 1

TECHNOLOGICAL PROCESSES AND SKILLS

The learner will be able to apply technological processes and skills ethically and responsibly using appropriate information and communication technologies

Assessment Standards(ASs)

We know this when the learner:

1.3 performs, where appropriate, scientific investigations about concepts relevant to a problem, need or opportunity using science process skills;

1.6 chooses one of these solutions, giving valid reasons for the choice, and further develops the choice with graphics and/or modelling;

Table 3.5

3.3 Why a light bulb lights up[3]

3.3.1 TECHNOLOGY

3.3.2 Grade 6

3.3.3 SYSTEMS AND CONTROL: AN ELECTRICAL SHOCK

3.3.4 Module 14

3.3.5 Why does a light bulb in a circuit light up?

3.3.6 BACKGROUND INFORMATION

The electrical energy is converted into heat energy, which causes the glow (incandescence). This happens because the wolfram wire (filament) in the bulb becomes hot because of its resistance to the electric current. The glass globe is filled with gas and this keeps the wire from being burnt out. Apparatus like light bulbs, loudspeakers and stove plates that generate light, sound and heat also offer a type of resistance to the electrical current. An electric engine is a motor that generates motion.

Assignment 1

(a) Build the simple electric circuit shown in the sketch.

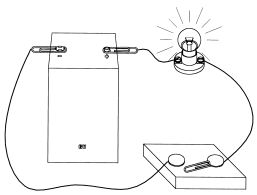


Figure 3.18

Draw a diagram to illustrate the circuit.

(a) Add another light bulb in series in the electric circuit. Is the light emitted from the light bulb brighter or duller?

Supply the **reason** by underlining the correct word: The energy that is available for each light bulb is (halved / doubled).

What will happen if one of the light bulbs stops working / breaks?

[3]This content is available online at <http://cnx.org/content/m22648/1.1/>.

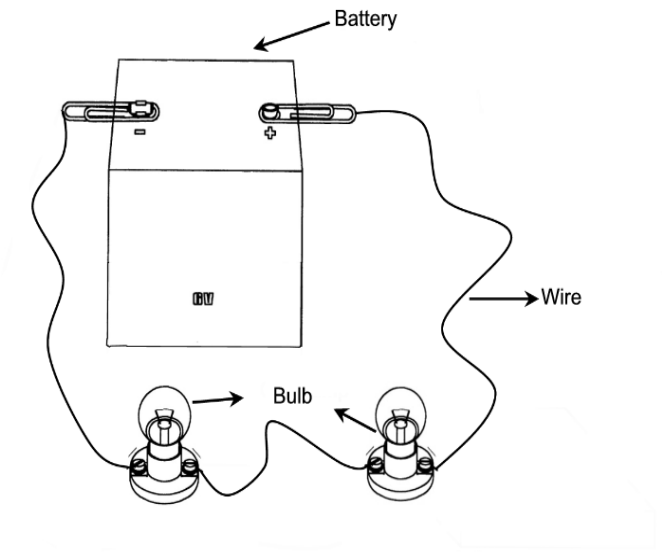


Figure 3.19

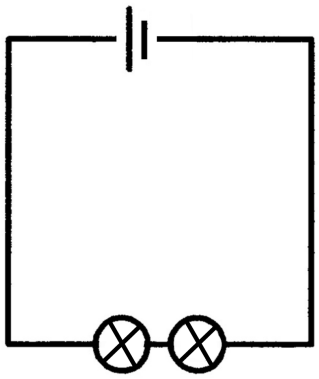


Figure 3.20

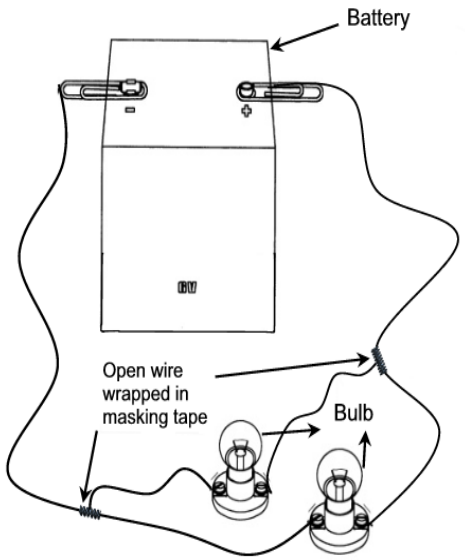


Figure 3.21

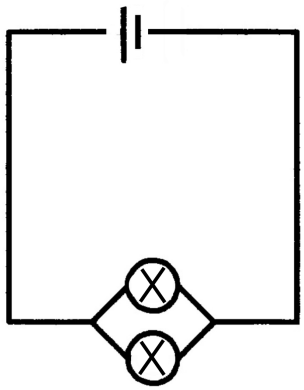


Figure 3.22

(a) Add another light bulb to the circuit in parallel, in circuit (a). **Do both light bulbs glow equally brightly?**

Supply the **reason** by underlining the correct word: The amount of energy supplied to each of the light bulbs is (the same / different).

What will happen if one of the light bulbs stops working / breaks?

(a) Application: Underline the correct expression to make the statement correct: The lights in our house remain bright, even if all of them are switched on at the same time. This is because they are connected (in series / in parallel).
(b) Touch the light bulbs.

Are they warm or cold to the touch?

A light bulb that emits light therefore supplies light energy, as well as_____ energy.

[LO 1.3

3.3.7 Assessment

Learning Outcomes(LOs)

LO 1

TECHNOLOGICAL PROCESSES AND SKILLS

The learner will be able to apply technological processes and skills ethically and responsibly using appropriate information and communication technologies

Assessment Standards(ASs)

We know this when the learner:

1.3 performs, where appropriate, scientific investigations about concepts relevant to a problem, need or opportunity using science process skills;

3.3.8 Memorandum

Assignment 1

(a)
(b) weaker
Halved
The current will not flow
(c) Yes
The same
The other bulb will keep on burning
(d) parallel
(e) warm
Warmth

3.4 Making a traffic regulator[4]

TECHNOLOGY

3.4.1 Grade 6

3.4.2 SYSTEMS AND CONTROL: AN ELECTRICAL SHOCK

3.4.3 Module 15

3.4.4 MAKING A TRAFFIC REGULATOR

To the Educator: This assignment can be executed as an individual or as a group project.

[4] This content is available online at <http://cnx.org/content/m22645/1.1/>.

(a) *What is the problem?* You are a citizen of Muddle Town. The town traffic is always chaotic because drivers do not stop their vehicles at the main street crossing. Everyone is permanently late for work because of the frequent accidents and regular congestion of traffic at this important street intersection.

(b) *What is required?* A "machine" that will regulate the traffic in a reasonable way from day to day.

(a) *What is your brief?* You are asked to design and build a prototype machine that can be erected at the street intersection to regulate the traffic.

(d) *What limitations are placed on your prototype?* You may use: 3 light bulbs of different colours (LED's) as resistors; a battery as energy source and a container for the battery; lengths of copper wire with clamps as conductors; a wooden board; 4 drawing pins; and a paper clip as the switch.

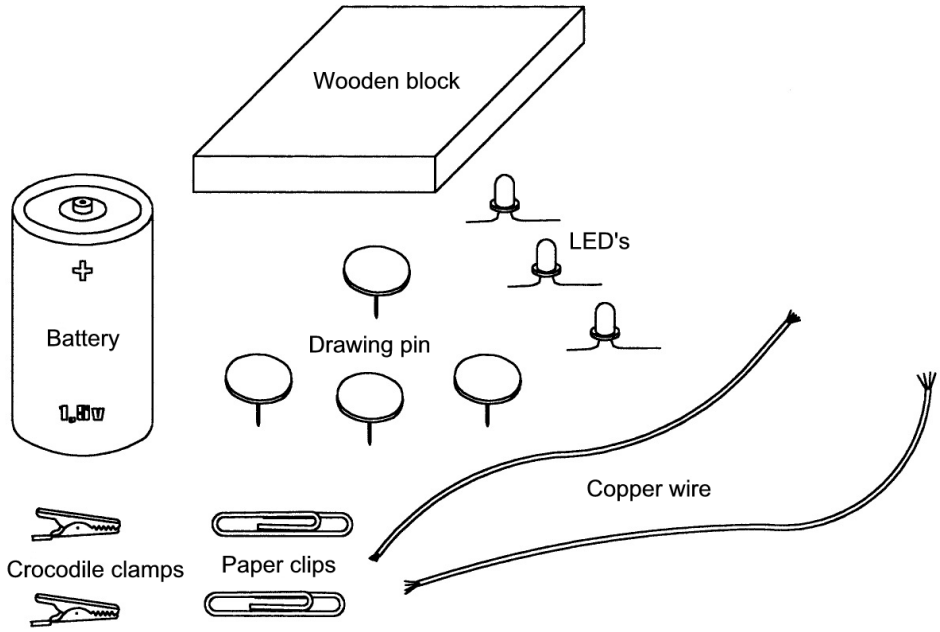


Figure 3.23

Only one light may glow at any particular time. The lights must indicate to motorists that vehicles in one traffic lane have to stop while vehicles in another lane may continue travelling. One of these machines will be erected on each of the corners at the intersection, but you need to build only one.

You may present the machine in any form, but it may not be higher than 30 cm and wider than 20 cm. It must be solid, stable and strong.

3.4.5 Assignment 1

3.4.6 [LO 1.2]

3.4.7 Research

Consult different sources and suggest at least three solutions for this problem. Draw sketches of these solutions or write notes about the possibilities that you are suggesting.

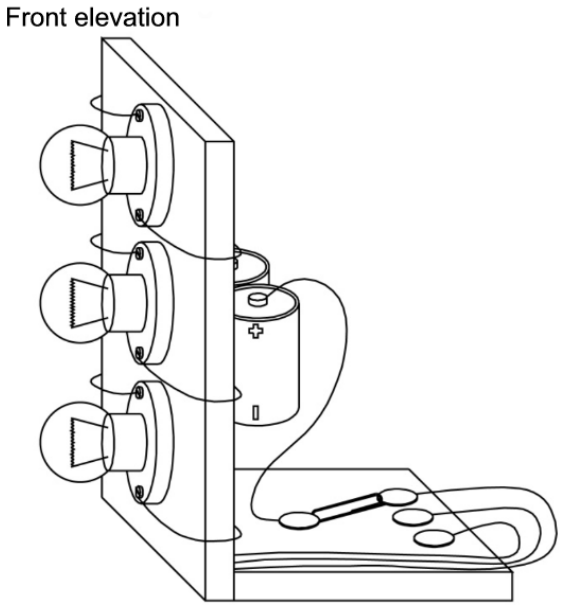


Figure 3.24

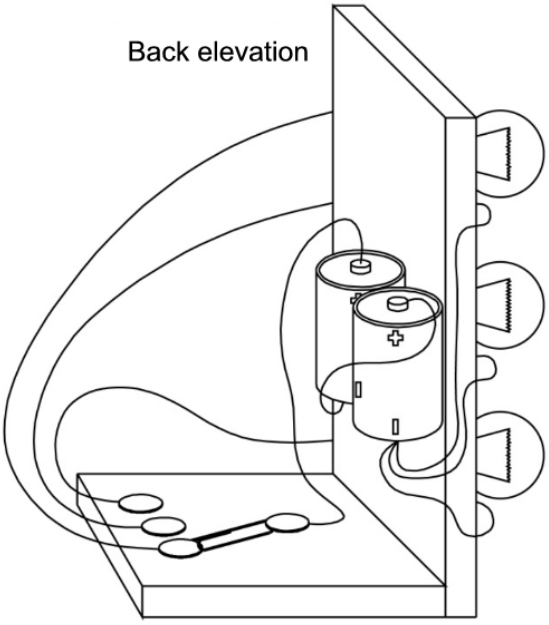


Figure 3.25

3.4.8 Assignment 2

3.4.9 [LO 1.5]

3.4.10 Design

(a) Make free-hand drawings of three circuits that could provide solutions to the traffic problem. Also provide labels.

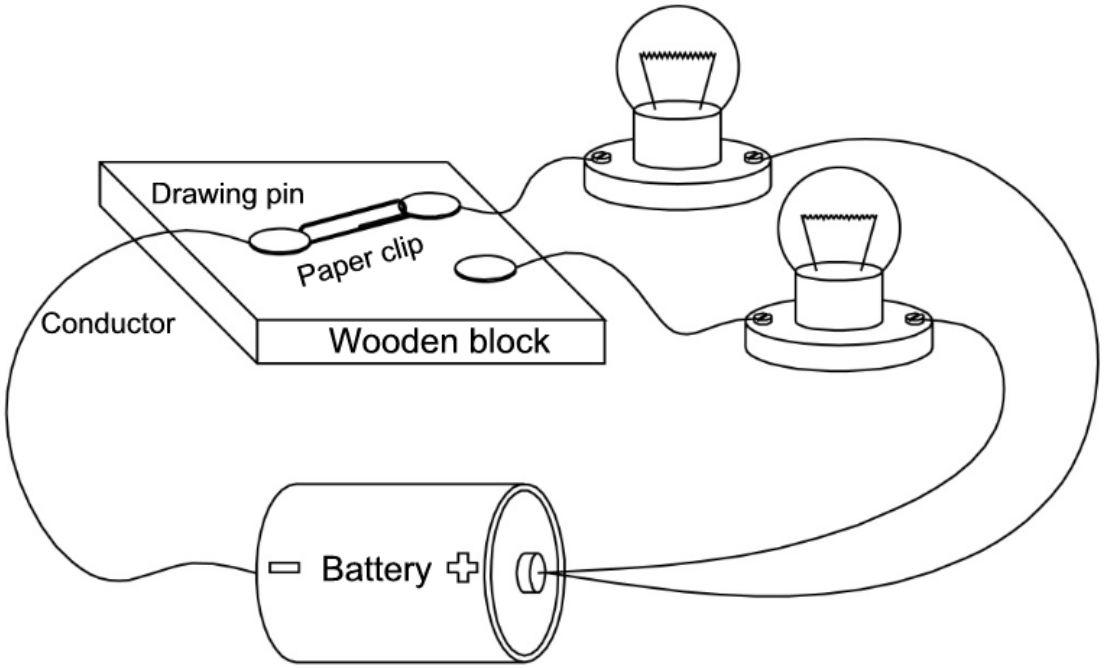


Figure 3.26

Your final choice
Draw the circuit diagram of your final choice.
[LO 1.6]
SUGGESTION!

- Must the lights be connected in serial or in parallel if they need to work one at a time?

- What must be shifted to a different position so that only one light will light up at a time?

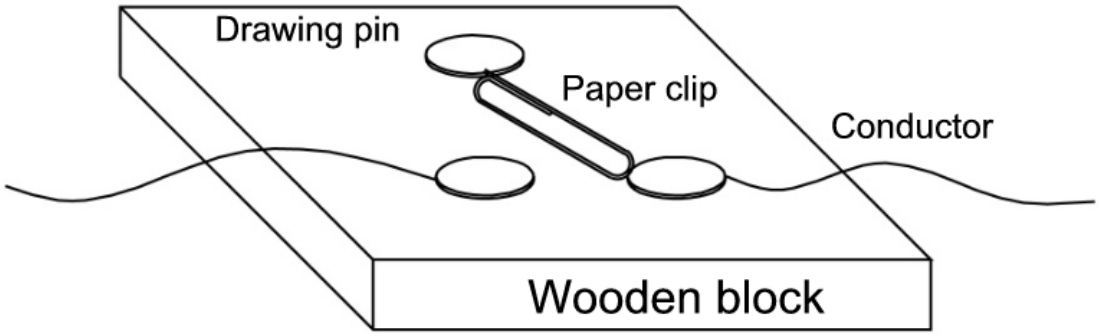


Figure 3.27

- Design a stand on which the lights, switch and battery can be mounted for the machine to work. This machine will eventually be controlled automatically, but someone will have to be employed to operate the changing of the lights, in the mean time. Discuss the requirements for such a stand with the members of your group. Indicate the dimensions so that it will be possible for other people to understand your ideas and how the machine works.

[LO 1.5]
Develop your best idea fully.

3.4.11 Assignment 3

3.4.12 [LO 1.9]

3.4.13 Manufacturing

(a) Build the stand for the circuit. What materials will you be using?

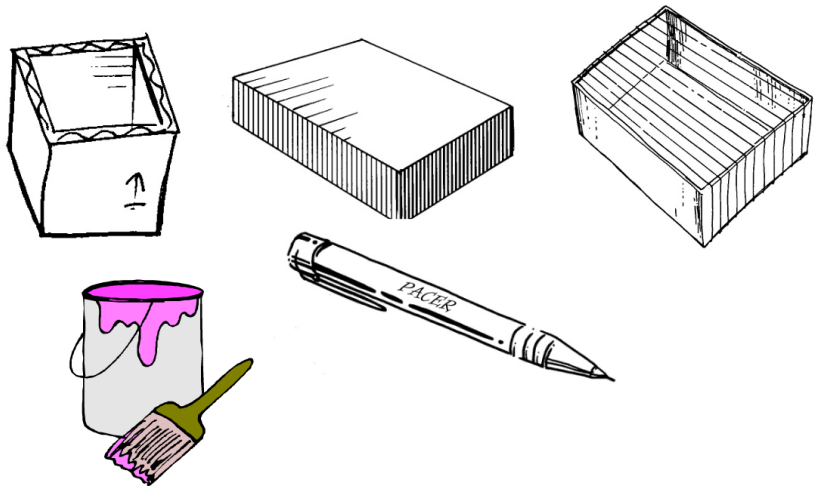


Figure 3.28

(b) Which tools will you be using?

Figure 3.29

(c) Which action will you be taking – give a step by step explanation of what you will do:

[LO 1.8]

(a) Mount the circuit on the stand.
(b) Demonstrate your invention to the rest of the class and explain how it works.
(c) Provide a suitable name for your invention.
(d) Write a step-by-step description of how you made your invention.

[LO 1.7]

3.4.14 Assignment 4

3.4.15 [LO 1.10]

Evaluation

(a) List three good aspects of your invention: List three weak aspects of your invention.
(b) What would you do differently if you had to design this invention and make it again?
(c) How do you feel about your invention when you compare it with those of the rest of the class?
(d) Make a 3-D drawing (in colour and with labels) of your final product.

3.4.16 Assessment

Learning Outcomes(LOs)

LO 1

TECHNOLOGICAL PROCESSES AND SKILLS

The learner will be able to apply technological processes and skills ethically and responsibly using appropriate information and communication technologies

Assessment Standards(ASs)

We know this when the learner:

1.1 finds out about the background context when given a problem, need or opportunity, and lists the advantages and disadvantages that a technological solution might bring to people and the environment;

1.2 finds out about existing products relevant to a problem, need or opportunity, and identifies and compares their design aspects (e.g. who it is for, what it is for, what it looks like, what it is made of, how well it works, whether it will affect the environment);

1.3 performs, where appropriate, scientific investigations about concepts relevant to a problem, need or opportunity using science process skills;

1.4 writes or communicates a design brief for the development of a product related to a given problem, need or opportunity that clarifies the technological purposes of the solution;

1.5 suggests and records at least two alternative solutions to the problem, need or opportunity that link clearly to the design brief and to given specifications and constraints (e.g. people, purpose, safety, environmental impact, appearance);

1.7 develops plans that detail the making steps, including drawings and sketches that help to clarify the plans;

1.8 chooses and uses suitable tools to make products by measuring, marking out, cutting or separating, shaping or forming, joining or combining, and finishing the chosen materials;

1.9 works efficiently and safely;

1.10 evaluates the product according to the design brief and given specifications and constraints (e.g. people, purpose, environmental impact, safety, appearance), and suggests improvements and modifications if necessary;

1.11 evaluates the plan of action followed and suggests improvements and modifications if necessary;

1.12 draws appropriate sketches (e.g. labelled two-dimensional drawings of ideas, enhanced drawings of final solutions and drawings showing measurements) to communicate different information appropriately and effectively.

3.4.17 Memorandum

Assignment 1

The amount of trouble that learners took to find the various possible solutions to the problem is evaluated.

Assignment 2

Check whether the required components for a circuit had been included in the learner's final choice.

The limitations for the prototype are the minimum components that could be used to supply the cheapest possible circuit. However, encourage learners to be original and creative.

(b) It is important that the learners are able to represent the circuit in a scientific way.

(c) It is important that learners experiment with their circuits in order to find the positive and negative aspects of each.

Parallel

At the switch

(a) Encourage learners to be creative and original when designing a mount for the circuit. Given the maximum size, encourage learners to make the mount as compact and practical as possible. This is what the teacher will be looking for during the assessment.

Assignment 3

(a) Check whether the specifications of the mount in the sketch agree with the real product.

(b) Consumable items are materials, so you can expect as answers paint, Koki pens, a variety of boxes, cardboard, etc.

(c) Tools are reusable items, so you can expect answers like scissors, a hammer, paintbrushes, pliers, etc.

(d) for the circuit – connect, join up, attach, place, hammer, press, slide, mount, drive, etc.

for the mount – clip, cut, fold, bend, paste, attach, place, colour in, staple, etc.

(g) Evaluate each learner's originality and creativity.

(h) The materials and the tools that were used are now used together with the actions to give a step by step description of how the circuit and mount were made.

Chapter 4

Term 4

4.1 Hydraulics and pneumatics[1]

TECHNOLOGY

Grade 6

HYDRAULICS AND PNEUMATICS

Module 16

HYDRAULICS AND PNEUMATICS

Background

Hydraulics is the study of the movement of liquid and the utilisation of its force in the form of mechanical movement. Hydraulics is based on the principle that force can be transferred by a liquid. Hydraulic machines have parts that can be controlled by making use of a liquid under pressure. A hydraulic system contains a pipe that is filled with a liquid such as oil, and a valve/piston that moves to and fro in the pipe. When the liquid in the pipe is put under pressure, it causes the valve/piston to move, which sends the force from one end of the pipe to the other.

Pneumatic systems have parts that can be controlled through compressed air. In a pneumatic system, air causes the piston/valve to move and thus the force is carried over from one position to the other. A bicycle pump and a vacuum cleaner are pneumatic systems because each has a pump that transfers air from one place to another and thus transfers a specific force. In a vacuum cleaner a pump sucks air from an area, and this creates a vacuum. Dust from outside is then sucked into the vacuum in order to fill the area.

If we have to move heavy objects by making use of a compressed liquid we use a _ _ _ _ _ _ _ _ _ _ _ _ system. Extremely powerful machines that can press, push or lift, operate hydraulically. A hydraulic system greatly increases the force that an object exerts.

Movement is controlled by making use of a liquid where levers and cables would be inadequate.

ASSIGNMENT 1:

To make a simplified hydraulic pump

[LO 1.3]

Requirements:

A plastic tube more or less 40 cm long

Adhesive tape

A heavy object

Water

Two large balloons

Two 2 ℓ plastic bottles

Two rubber bands

A pair of scissors

[1] This content is available online at <http://cnx.org/content/m29590/1.1/>.

A funnel

Two empty cool drink tins

Method:

Put the open end of the balloon over the end of the plastic tube and seal it with adhesive tape.

Cut off the top part of each bottle just above the labels.

Make a small hole close to the bottom, near the base of each bottle.

Push the balloon and the plastic tube through the hole of bottle B.

The balloon must lie on the bottom of one of the bottles.

Push the other end of the plastic tube through the opening of bottle A. To fill the balloon in B, carefully pour water into the tube by using the funnel. Fill the other balloon with water and fix it to the plastic tube in A, as in step 1. Try to leave as little air as possible in the balloons and the tube.

Place the tins in the bottles on top of the balloons. Then carefully place the heavy object on top of the tin in B.

7. Now press hard, but carefully, on the other tin in A.

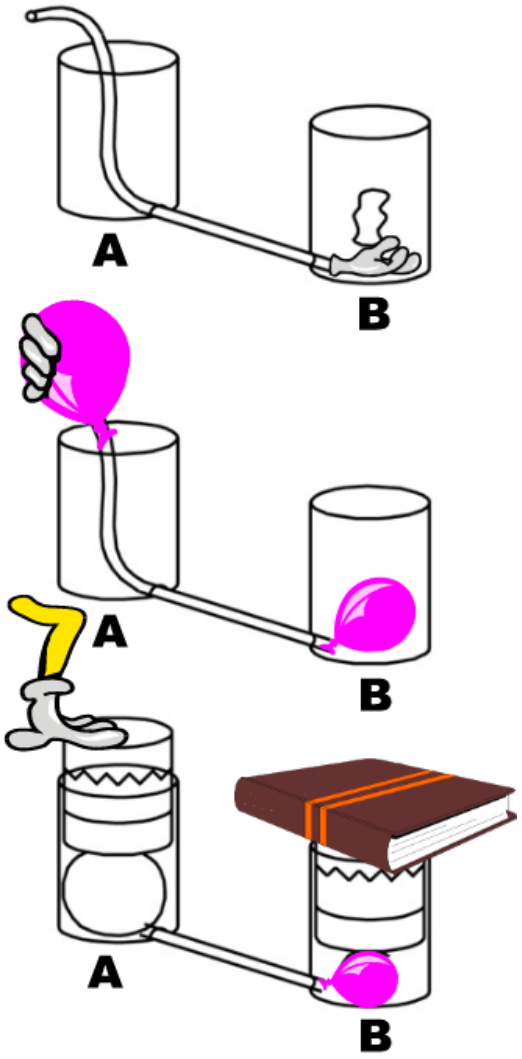


Figure 4.1

What are your observations?

More water is forced from the balloon in A to the balloon in B. This pushes the tin upwards, which then causes the heavy object to be pushed upwards as well.

Why does it work?

It is difficult to compress water. When you put water under high pressure in one place, it will flow out with the same force elsewhere. The water therefore transfers the force from one tin to the other. All hydraulic machines work on this principle.

Background

Powerful bulldozers, fire engines and cranes use hydraulic power to lift heavy loads easily. A liquid is carried from a pump by means of pipes to cylinders where the liquid pushes valves/pistons out with great

force. The pistons force the shovel into the soil and a heavy load of soil can thus be lifted. (A valve causes air or a liquid to move in one direction, but also prevents air or water from flowing back again.)

The advantage of making use of air pressure is that air is clean, freely available and safe under low pressure. Under high pressure air can be very dangerous. By nature air is resilient and this can cause a problem

Hydraulic systems are sometimes better than pneumatic systems because motion can be obtained more easily. When a leak occurs in a hydraulic system, it could be very messy.

ASSIGNMENT 2:

To investigate a hydraulic and pneumatic system

[LO 1.3]

Requirements:

Two syringes of equal size.

A plastic tube of about 10 cm that will fit tightly over the opening of both syringes.

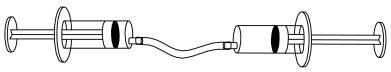


Figure 4.2

Method:

Draw out the plunger (piston) of one syringe and push in the plunger of the other syringe.

Connect the two syringes by means of the plastic tube.

Push in the plunger of one syringe.

Draw that plunger out again.

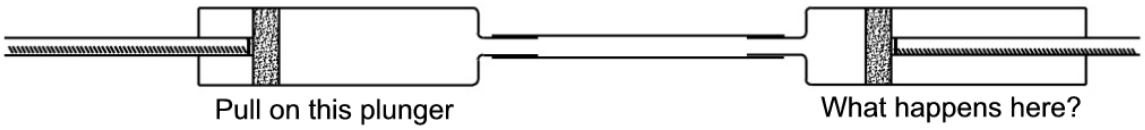


Figure 4.3

Observation

When one of the plungers is pushed in, the plunger of the other syringe is pushed out by the same distance. When the plunger of the one syringe is pulled out, the piston of the other syringe is sucked in by the same distance in the tube.

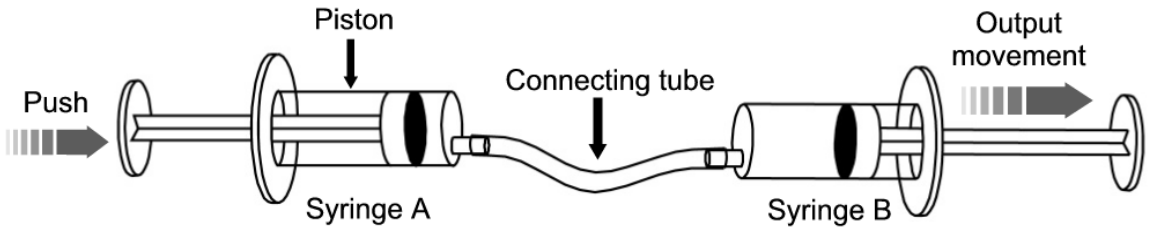


Figure 4.4

ASSIGNMENT 3:
To replace air with water or oil
[LO 1.3]
Question:
How do the syringes that are filled with water compare with the syringes filled with air? Which system works best?
Underline:
The pneumatic/hydraulic system works better.
ASSIGNMENT 4:
To investigate the effect of syringes of different sizes on each other
[LO 1.3]

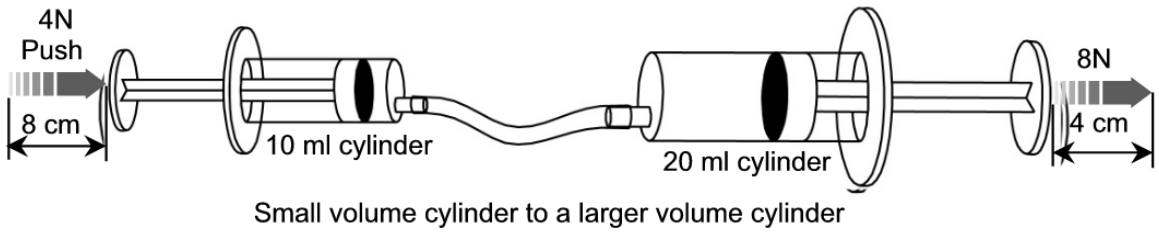


Figure 4.5

Method:
For example, connect a 10 ml syringe to a 20 ml syringe.
Push in the plunger of the small syringe and observe how many mm the plunger of the big tube moves out.
Also pull the plunger of the small syringe out and observe how many mm the plunger of the big tube moves in.
Underline:
When a small cylinder has half the volume of a big cylinder, the plunger of the big cylinder moves (half/quarter of) the distance of what the small cylinder moves.
The force exerted by the big cylinder is (less/more), namely half as much (more/less).

ASSIGNMENT 5:
[LO 1.3]

Now connect a big syringe with two smaller syringes, for example a 20 ml syringe with two 10 mm syringes by using a T-joint connection. The plunger in the big syringe must be pulled out and the plungers of the smaller syringes must be pushed in.

Push the plunger of the big syringe in and observe how many ml the plungers of the
smaller syringes move up.

Now push in the plungers of the smaller syringes and observe how many ml the plunger of the big syringe moves up.

Underline:

Because the smaller syringes together have the same volume as the big syringe, their plungers move up (half the/the same) distance as the plunger of the big syringe when it is pushed in.

The force that is exerted in the big syringe is (a quarter/half) less in each small syringe.

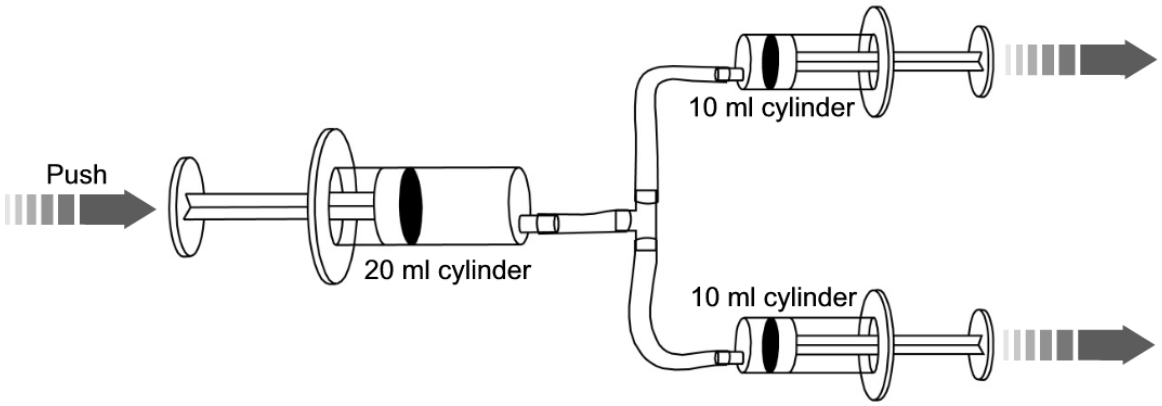


Figure 4.6

Background:

In industry cylinders are used to perform the same tasks. If a pneumatic cylinder must be used often, a compressor with a control valve is used to let air into the cylinder. The cylinders are mechanically connected to the tube with an attachment and to the syringe with a pivot.

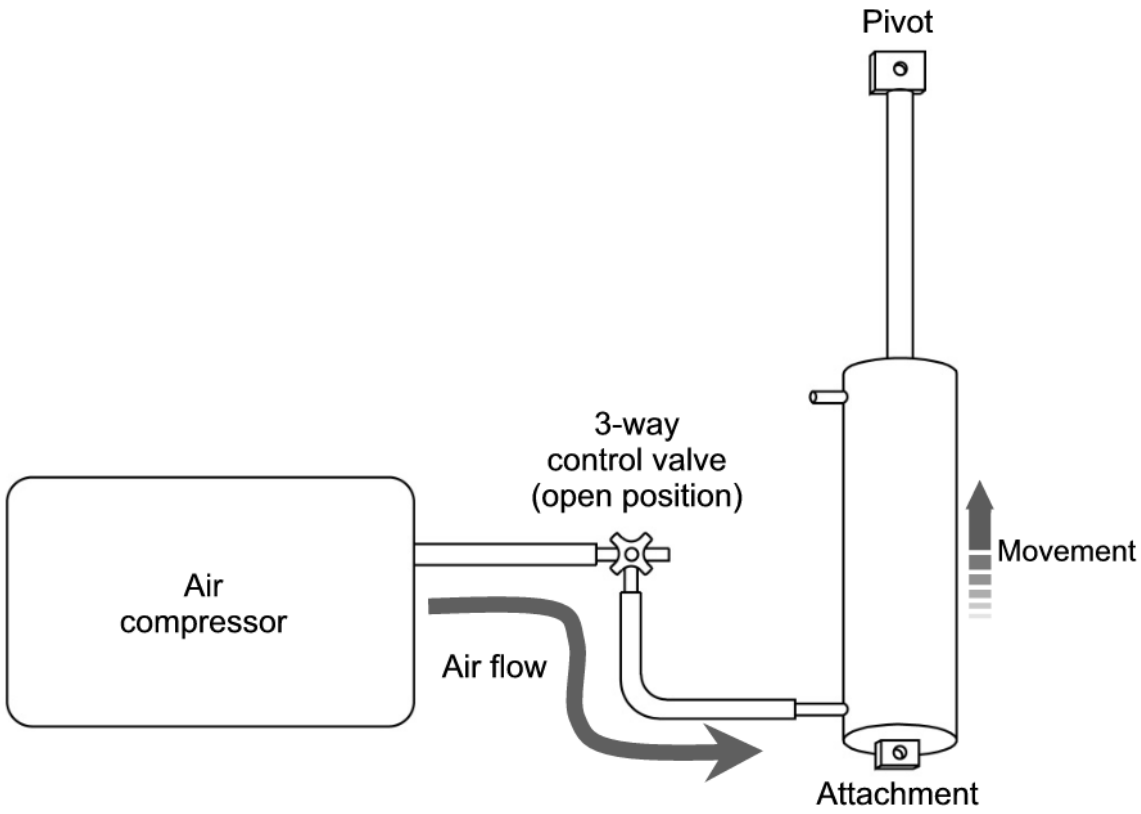


Figure 4.7

Assessment

Learning outcomes(LOs)
LO 1
Technological Processes and SkillsThe learner will be able to apply technological processes and skills ethically and responsibly using appropriate information and communication technologies.
Assessment standards(ASs)
We know this when the learner:
1.3 performs, where appropriate, scientific investigations about concepts relevant to a problem, need or opportunity using science process skills:planning investigations;conducting investigations;processing and interpreting data;evaluating and communicating findings
continued on next page

Table 4.1

4.2 Design proposal for a hydraulic/pneumatic puppet[2]

4.2.1 TECHNOLOGY

4.2.2 Grade 6

4.2.3 HYDRAULICS AND PNEUMATICS

4.2.4 Module 17

4.2.5 DESIGN PROPOSAL FOR A PNEUMATIC /HYDRAULIC PUPPET

Problem situation

The younger patients of the Morningside Children's Hospital are very depressed. It is not only because they suffer pain as a result of their illness, but also because nobody visits them to brighten up their day. Their families all live far away. The doctors and nurses observed this need and decided to build them a puppet theatre to brighten up their day and make them laugh again.

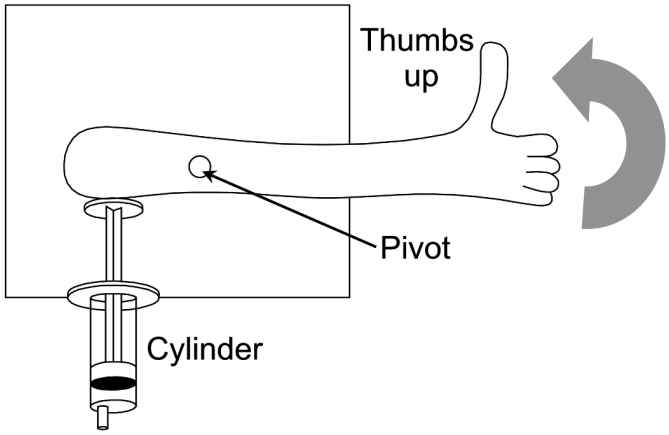


Figure 4.8

Design proposal

Use your knowledge of pneumatic and hydraulic systems as well as of mechanics to design and construct a character with a surprise element that can be used in the puppet theatre to brighten up the day of the younger patients.

[2]This content is available online at <http://cnx.org/content/m22660/1.1/>.

4.2.6 ASSIGNMENT 1:

[LO 1.3]

To analyse the situation

a) Identify the words that you do not understand. Discuss them with your teacher.

b) Briefly rewrite and describe the situation in your own words.

4.2.7 ASSIGNMENT 2:

[LO 1.3]

To write a design proposal by completing the sentence:

Draft a design proposal by completing the following sentence. (The design proposal is the possible solution to the problem.)

I am going to design and make a_____ (product/what) for_____
(user/who) that operates by way of a ...(how) system, so that it has a
_____ that will make a depressed person
_____when it is used in the puppet theatre (its function).

4.2.8 ASSIGNMENT 3:

[LO 1.3]

Research

In this module we have already been introduced to the way in which pneumatic and hydraulic systems work. If you wish, you can do further research. Write down any interesting information you might have. Also indicate the source you have consulted.

Source:

4.2.9 ASSIGNMENT 4:

To brainstorm possible solutions to the problem

[LO 1.3]

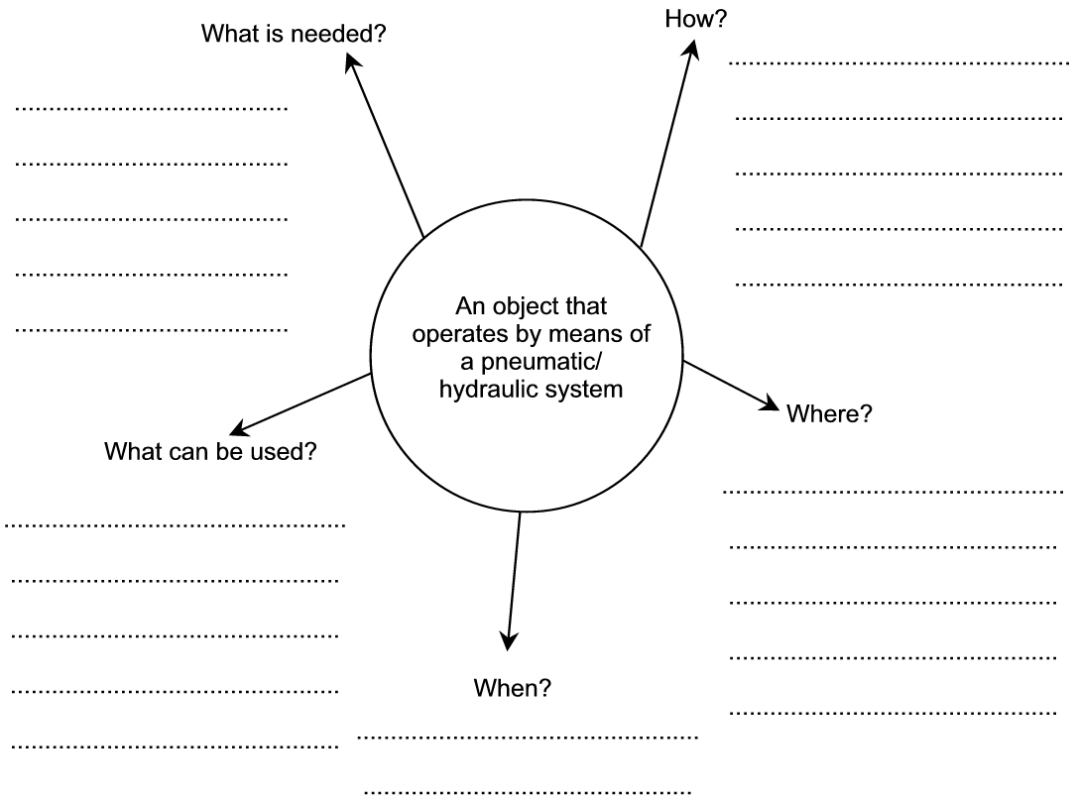


Figure 4.9

Design and make :
Limitations / Specifications (the rules that must be followed)

1. The material you have to use consists of two or three syringes, a plastic tube and a T-connection (if necessary) for the pneumatic or hydraulic system.
2. The pneumatic/hydraulic system must not be visible to the audience.
3. The character and its moving part/parts must be made from thick cardboard and held up by a round dowel stick. By pushing the plunger of the syringe in, or pulling it out, the required movement will be caused in the other syringe(s), which will cause the moving part to react as desired. The moving part may be joined to the static part by means of one or more rivets.
4. The completed article must not be bigger than an A3 page.
5. It must be completed within two hours
6. It must be safe, because a child must also be able to handle it.
7. It must look attractive and demonstrate the learner's creativity.

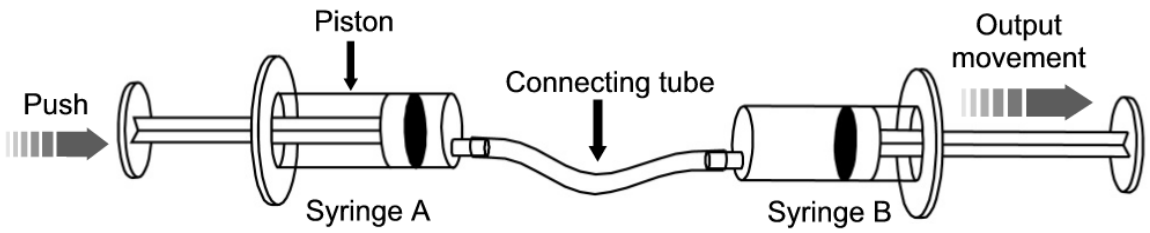


Figure 4.10

4.2.10 ASSIGNMENT 5:

Decide which of your solutions to Assignment 4 you would like to develop further, and indicate your choice by circling the solution you have chosen.
[LO1.3]

4.2.11 ASSIGNMENT 6:

Draw freehand sketches of the front and back elevation of your chosen design
[LO 1.3]

- Colour the front elevation to indicate what the final product should look like and give all the real dimensions and other relevant information.

Front elevation

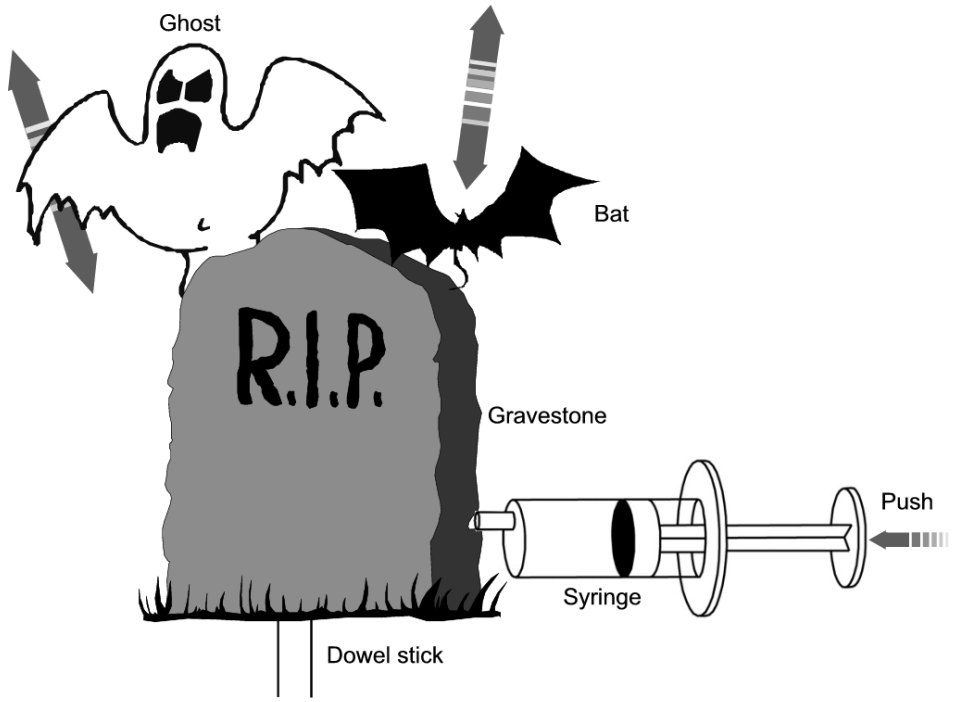


Figure 4.11

Rear elevation

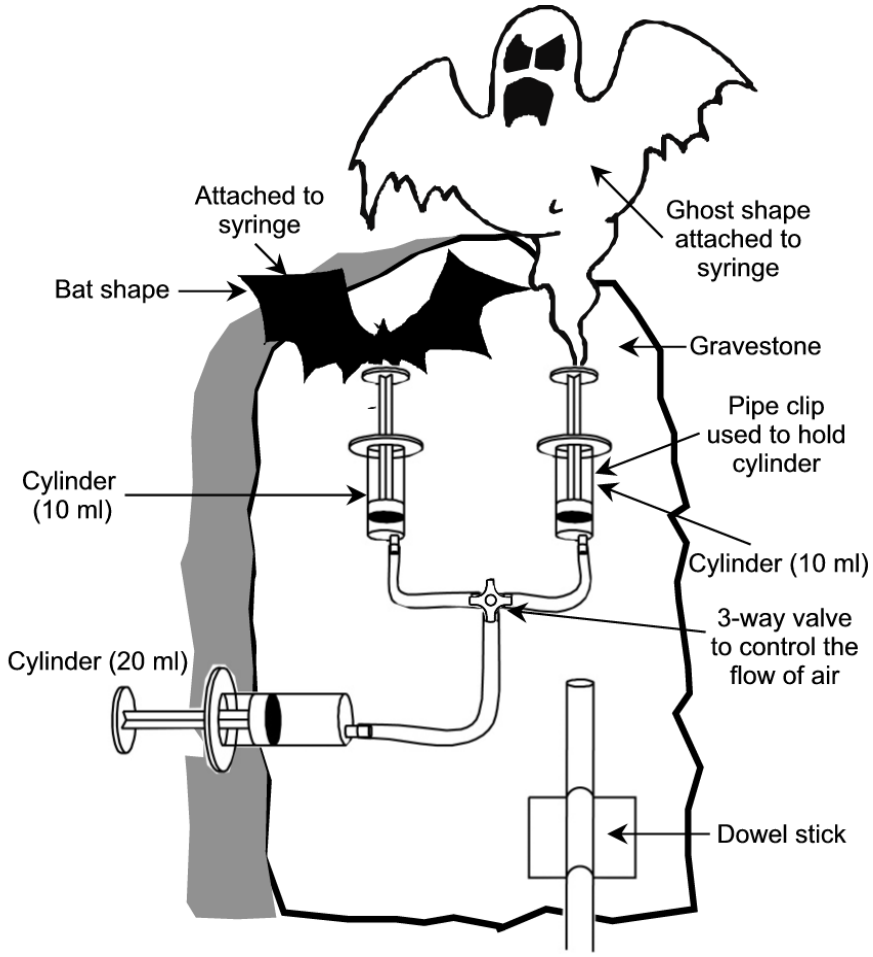


Figure 4.12

REALISATION

4.2.12 ASSIGNMENT 7:

- Which materials are you going to use? (See specifications.)
- Which tools are you going to use?

[LO 1.3]

4.2.13 ASSIGNMENT 8:

[LO 1.3]

Write down the steps you are going to follow under the following headings: (Use only one verb per sentence and write clearly)

[LO 1.3]

- Measure
- Shape
- Join

4.2.14 ASSIGNMENT 9:

Now make your own article
[LO 1.3]

4.2.15 Assessment

Learning outcomes(LOs)
LO 1
Technological Processes and SkillsThe learner will be able to apply technological processes and skills ethically and responsibly using appropriate information and communication technologies.
Assessment standards(ASs)
We know this when the learner:
1.3 performs, where appropriate, scientific investigations about concepts relevant to a problem, need or opportunity using science process skills: • planning investigations; • conducting investigations; • processing and interpreting data; evaluating and communicating findings

Table 4.2

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